REV L

SH 1

DWG. NO. 150-045264

APPLICATION

NEXT ASSEMBLY	FINAL ASSEMBLY

REVISIONS

REV	DESCRIPTION	DATE	APPROVED	APPROVED
A	Initial Release per DCN W1894	12-19-02	V. Wallace	---
B	Change per DCN W2610	12-23-02	R. DuRall	V. Wallace
C	Changes per DCN W2696	03/06/03	R. DuRall	V. Wallace
D	Changes per DCN W2752	03/28/03	R. DuRall	V. Wallace
E	Changes per DCN W2842	05/14/03	R. DuRall	V. Wallace
F	Changes per DCN W2865	05/30/03	R. DuRall	V. Wallace
G	Changes per DCN W2957	07/23/03	R. DuRall	V. Wallace
H	Changes per DCN W3123	10/03/03	R. DuRall	V. Wallace
J	Changes per DCN W3238	12/15/03	R. DuRall	R. Talken
K	Changes per DCN W3712	07/02/04	R. DuRall	DAC/RWT
L	Changes per DCN W3935	09/16/04	R. DuRall	V. Wallace

See Revision History page for description of revisions.

APPROVALS	DATE
DRAWN Randy Harper	12-16-02
CHECKED Kevin Compos	12-16-02
ENGINEER Buddy Jackson	12-16-02
ISSUED Vern Wallace	12-16-02

Typed signatures indicate approval. Handwritten signature approval of this document is on file at Wulfsberg Electronics, Prescott, Arizona.

CHELTON FLIGHT SYSTEMS

SYSTEM INSTALLATION INSTRUCTIONS

SIZE	CAGE CODE	DWG NO.	REV
A	1B7G3	150-045264	L

SCALE: NONE

DO NOT SCALE DRAWING

Contents

REVISION HISTORY

System Installation Instructions, Document 150-045264

REV	DESCRIPTION	DATE	APPROVED	APPROVED
L	1. Corrected typos in IDU TSO Applicability list in Chapter 1. 2. Changed Loctite from 242 to 222 in Chapter 1 and Chapter 2. 3. Modified Notes and Limitations to include STC SA02220AK. 4. Changed note on AHRS mounting to include 0° pitch in Chapter 2. 5. Changed AHRS mounting washer from brass to aluminum in Chapter 2. 6. Added pull test requirements of ADC, AHRS, and GPS for Rotorcraft installations in Chapter 2. 7. Added notation to document locations of all equipment added per these instructions to the appropriate ICA in Chapter 2 and Chapter 6. 8. Added P3/4 Pin 39 to Chapter 3. 9. Removed all reference to letter options in the Ground Maintenance Functions of Chapter 5. 10. Modified View Bitlog.dat box to reflect current software in Chapter 5. 11. Added settings descriptions in the System Speed Settings box of Chapter 5. 12. Added System Engine Settings in the View System Limits section of Chapter 5. 13. Added A429 Com RX items in System User Programmed Settings box to reflect current software in Chapter 5. 14. Removed Stall Warning Flag setting in IDU Limits program description in Chapter 5. 15. Changed IDU Limits program screen shot in Chapter 5. 16. Added OAT Probe Calibration check in Chapter 6. 17. Changed Crossbow Installation Manual document number in Chapter 6. 18. Added Litef LCR-93 AHRS option checks and alignment in Chapter 6. 19. Changed Ground Maintenance menu selection from “Items” to “options” in Chapter 8. 20. Included Bell 407 helicopter to Appendix A. 21. Added climb speed limitation for Bell 407 in Appendix A. 22. Removed reference of “Item G” in Appendix B. 23. Removed reference of “Item H” in Appendix C. 24. Added Litef SIL reference for compass alignment in Appendix D. 25. Added STC number for Citation installation in Appendix E.	09/16/04	R. DuRall	V. Wallace

REV	DESCRIPTION	DATE	APPROVED	APPROVED
	26. Added Appendix F. 27. Per DCN W3935			
K	28. Changed picture of tray back 401-045515-04 to proper configuration in Chapter 2. 29. Corrected typo of ADC-2000 description and added OAT Calibration step, and twin fuel flow note in Chapter 2. 30. Corrected typo of nutplate on IDU Mounting Bracket figure in Chapter 2. 31. Corrected GPS antenna sealant description in Chapter 2. 32. Added new description of Com23 and Com24 TX and UPS OUT/EFIS Valid pin in Chapter 3. 33. Modified Com21 and Com22 ARINC-429 transmit label list in Chapter 3. 34. Added Com23 and Com24 ARINC-429 transmit label list in Chapter 3. 35. Modified ARINC-429 receive label list in Chapter 3. 36. Changed label of AHRS connector to "Hardware Bit Status" in section 4.7F of Chapter 4. 37. Corrected typo of HDG button in Chapter 5. 38. Added SmartMedia card operation note in Chapter 5. 39. Modified IDU Ground Maintenance menu to reflect v5.0A options in Chapter 5. 40. Added Version 4 limits, Mach Meter, ARINC-429 Port, Pitch Limit Indicator, Remote Com Tuning, and EFIS Valid Polarity options to IDU Limits section of Chapter 5. 41. Added information to Path Quickening description in Chapter 5. 42. Modified VHF interference frequencies for GPS Ground and Flight Tests sections to meet DO-229C requirements; removed step 6.1.4; and modified step 6.2.1 to define leak test in Chapter 6. 43. Added altitude and airspeed test points in Chapter 6. 44. Corrected GPS startup time in steps 5.7 and 5.9 of Chapter 6. 45. Removed "GPS VLOI" from the FAULTS menu in Chapter 6 and Chapter 8. 46. Changed "NO GPS" flag to "GPS LON" in Ground and Flight Tests sections on Chapter 6 and Chapter 7. 47. Changed test criteria for altitude test in Chapter 7. 48. Added Path Quickening test step in Chapter 7. 49. Added "ON/OFF" switch to L-3 Skywatch Interface figure in Appendix C. 50. Added Litef LCR-93 option to Chapter 1 and Appendix D. 51. Added Appendix E for Cessna 501 Citation installation and STC.	7/2/04	R. DuRall	R. Talken

REV	DESCRIPTION	DATE	APPROVED	APPROVED
	52. Modified Revision History page per DCN W3712.			
J	1. Added cooling requirements. 2. Added Appendix B, Appendix C, and Install Kits -04 and -05. 3. Modified electrical backup instrument instructions. 4. Modified ADC mounting requirements. 5. Modified GPS mounting requirements. 6. Added composite airframe mounting requirements for GPS antenna. 7. Modified AHRS mounting requirements. 8. Added item "K" for internal temperature measurement. 9. Added Version 3 limits information to IDU Limits program. 10. Added ADC EMI testing, fuel flow testing and re-arranged attitude testing in Ground Functional test section. 11. Added test pilot requirements, modified flight test steps, added EMI testing for ADC, AHRS, and GPS, autopilot testing, limits verification, landing gear testing, Nav display testing in Flight Functional test section, per DCN W3238.	12/15/03	R. DuRall	R Talken
H	1. Changes to Revision History page, page numbering, removal of title page. 2. Added environmental and TSO qualifications. 3. Added installation kit parts. 4. Added connector termination. 5. Added fuel flow install instructions. 6. Added antenna mounting options. 7. Modified AHRS install. 8. Added IDU pin assignment. 9. Ground testing changes. 10. Flight testing changes. 11. Added troubleshooting chapter per DCN W3123	10/03/03	R. DuRall	V. Wallace
G	1. Remove Day VFR restriction for Rotorcraft. 2. Move Bell 206 install information to Appendix A. 3. Added note to 3 and 3.7G to clarify connector pinout. 4. Change operational warning for AHRS from 10 to 90 seconds, page 10 per DCN W2957	07/23/03	R. DuRall	V. Wallace
F	1. Changes to helicopter panel install. 2. Added single IDU install per DCN W2865	05/30/03	R. DuRall	V. Wallace
E	1. Changes to ADC, Inst. Panel, and added IDU BKLT and LND GR info. 2. Added helicopter requirements per DCN W2842	05/14/03	R. DuRall	V. Wallace
D	Changes to pages 5, 8, 16, 17, 47, 84, 98, 100, 101, 102, 103, 104, & 108 Per DCN W2752	03/28/03	R. DuRall	V. Wallace
C	Update Ground Maintenance and Flight Tests sections per DCN W2696	03/06/03	R. DuRall	V. Wallace
B	Change P/Ns Per DCN W2610	12-23-02	R. DuRall	V. Wallace
A	Initial Release per DCN W1894	12-19-02	V. Wallace	---

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Chapter 1

Introduction

ABOUT THIS GUIDE

This guide provides instructions for installing the Chelton Flight Systems EFIS products. Use it for new or retrofit installations. The most recent version of this installation guide is always available online at www.cheltonflightsystems.com.

WARNING!
These instructions are intended for use by installers familiar with standard aircraft avionics practices and methods of installation. If you do not have prior experience with or knowledge of avionics installations, do not attempt the following installation. Chelton Flight Systems will not be held liable for damaged items resulting from improper handling and installation.

You will find the stylistic elements listed in **Table 1** used throughout this guide. These styles are used to emphasize text, to make the information more accessible to you during the installation, and to make the online manual more interactive.

This guide includes installation and checkout procedures for the EFIS system to standards described in FAA Advisory Circular 23-1311-1A.

Chapter 1 Provides an **introduction** to the EFIS system to include a description of the EFIS system, parts list and list of special tools required.

Chapter 2 Includes **system installation**.

Chapter 3 Includes **EFIS pin assignments** for the IDU.

Chapter 4 Includes **system drawings**, both mechanical and electrical.

Chapter 5 Includes **EFIS configuration** procedures, IDU limits programming.

Chapter 6 Includes **ground functional test** procedures.

Chapter 7 Includes **flight functional test** procedures.

Chapter 8 Includes **troubleshooting** procedures.

Appendix A Includes system installation specific for **Bell 206/407 Helicopter** installation.

Appendix B Includes system installation specific information for the **L-3 WX-500 Stormscope®** interfacing.

Appendix C Includes system installation specific information for **traffic system** interfacing.

Appendix D Includes system installation specific information for **Litef LCR-93 AHRS** interfacing.

Appendix E Includes system installation specific for **Cessna 501** installation.

Appendix F Includes system installation specific for **Eurocopter AS 350/355 Helicopter** installation.

Table 1 Installation Guide Style Conventions

Style	Description	Uses
1. Tasks	Numbered steps that together form a set of instructions for installing a specific EFIS component.	The numbered task guides you through the proper sequence of installation procedures.
Checklists 	Installation procedures with checkboxes beside them. All the procedures in the checklist must be performed, but do not need to be performed in a specific order.	The checklist will help you track your installation progress. Write a checkmark in the checkbox after you complete each procedure.
NOTE:	Italicized text with black borders.	The note format is used to highlight and further explain certain installation and operational details.

WARNING! 	A graphical icon with an explanation point in the center, followed by bolded text with red borders.	This warning icon is used to flag important installation considerations. Failure to heed the information in the warnings could cause bodily harm, damage to the aircraft, or damage to the EFIS product.

UNPACKING THE EFIS

System components are shipped in packaging designed to protect the components during transit. Carefully unpack and identify each component using the list on page 8 and 9. Check the contents of the package against the packing list in the box. Visually inspect each individual component for any signs of damage.

Keep all shipping containers and packaging in case you need to return any items. Contact Chelton Flight Systems immediately if you find missing or damaged components. Before returning anything, please contact Chelton Flight Systems by one of the means below.

Phone: (208) 389-9959
Fax: (208) 389-9961
E-mail:support@cheltonflightsystems.com

You must file a claim for a damaged product within 48 hours of receiving the equipment.

Most of the items required for installation are supplied in the original package from Chelton Flight Systems. You may order supplemental items (not included in the package) from Chelton Flight System separately to further aid the installation process.

SPECIAL TOOLS

In addition to a standard aircraft mechanic's tool set, you will need crimp tools and locators that meet MIL specification M22520. These tools will ensure consistent, reliable crimp contact connections. If you do not have these specialized tools, contact Chelton Flight Systems for sourcing information. Refer to **Table 2** below for specifications.

Table 2 Special Tools Parts List

Tool Description	Part Number
Crimp Tool	M22520/2-01
Locator	M22520/2-07
Locator	M22520/2-08
Locator	M22520/2-02
Crimp Tool	M22520/5-01
Locator	M22520/5-05
Crimp Tool	M22520/1-01
Locator	M22520/1-12
Insert/Removal	M81969/39-01
Insert/Removal	M81969/14-01
Insert/Removal	M81969/17-03
Insert/Removal	M81969/19-06

You should also have the following tools and supplies on hand:

- Loctite® 222 Medium Strength Threadlocker for sensors and probes as required.
- A digital multimeter for testing internal terminators on cable assemblies, and for testing voltage of various outputs.
- Strain gauge that can measure push and pull forces of up to 50 pounds.
- A laptop computer with Crossbow AHRS "GyroView" and "IDU Limits" software installed. The laptop must have a 9-pin RS-232 serial port or a USB to Serial Port adaptor for use by GyroView.
- PS/2 compatible keyboard (IBM type)
- SmartMedia card reader/writer
- SmartMedia card (8MB to 64MB card)

NOTE: *The IDU will not recognize a 3 volt SmartMedia card greater than 64MB.*

SYSTEM DESCRIPTION

The FlightLogic synthetic vision EFIS is a complete flight/navigation instrumentation system that intuitively provides information to a pilot via computer generated screens shown on panel-mounted hardware.

The software screens consist of:

a primary flight display (PFD)
a navigation display (ND)

The panel-mounted hardware consists of one Primary Flight Display (that only shows the PFD screen) and one or more multifunction displays (MFD). The MFD can be configured by the pilot as a reversionary PFD or ND at the touch of a button. The ND can be further configured as a moving map, electronic HSI, a dedicated traffic display, or a dedicated weather display.

PFD **MFD**

The displays are comprised of a high-brightness backlit LCD screen, eight buttons, two control knobs, and an optional slip indicator. The buttons and slip indicator are also backlit and their brightness can be adjusted independently of the screen.

Remote-mounted equipment consists of an AHRS (Attitude/Heading Reference System), an ADC (Air Data Computer) with OAT probe, and a GPS WAAS receiver with antenna.

SYSTEM CONFIGURATION

Each display is driven by its own internal processor. A complete system consists of at least one MFD, one AHRS, one ADC, and one GPS receiver. All displays communicate with (but do not rely upon)

each other and all sensors are connected to the displays in parallel, so each display is independent from all others and, except for the PFD, can show any page at any time. The data transfer between components, along with the additional equipment that can be interfaced with the EFIS are indicated in the following block diagram.

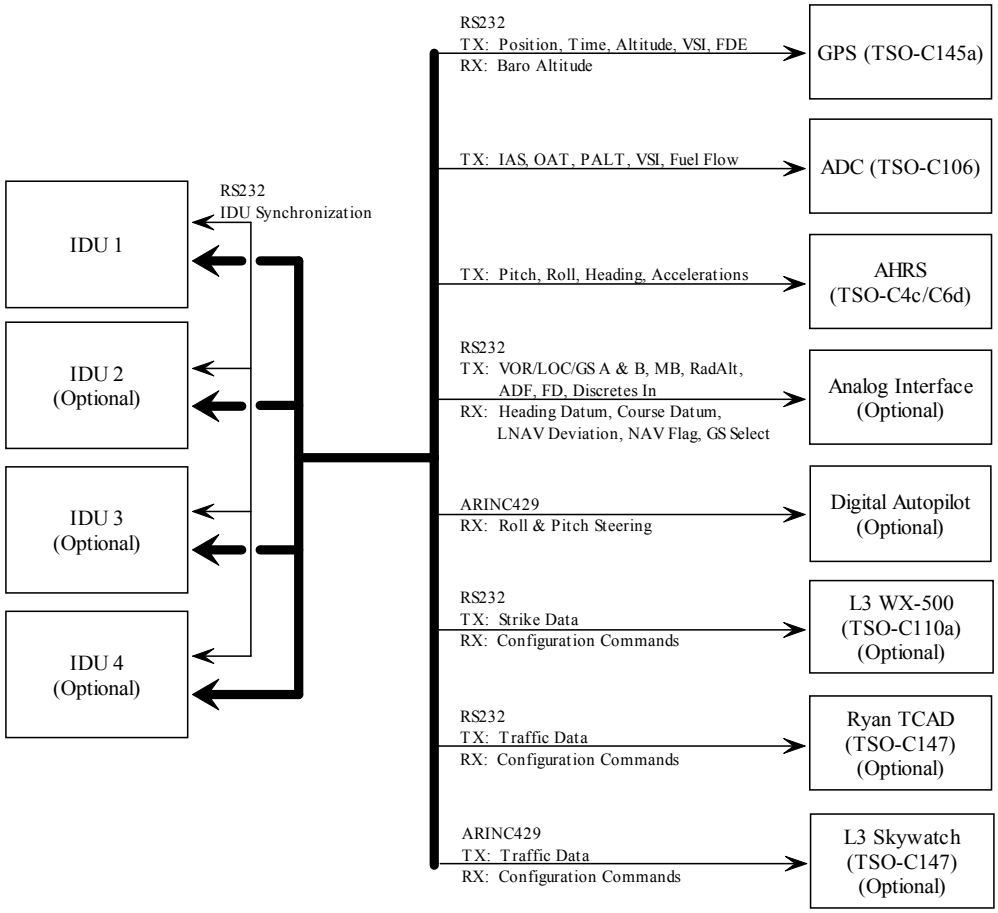


Figure 1: Block Diagram EFIS System

CAUTION/WARNING/ADVISORY SYSTEM

The Chelton FlightLogic EFIS includes an integrated auditory caution/warning/advisory (CWA) system that monitors a wide variety of parameters and provides auditory annunciations for conditions that demand pilot awareness. Auditory annunciations take the form of either a voice warning or a chime.

Annunciations are grouped into three categories: warning, caution, and advisory. Warnings are accompanied by a red flag and repeat until acknowledged by the pilot (by pushing the MUTE button on yoke or panel), or the condition is corrected. Cautions are accompanied by an amber flag and are annunciated then repeated once. Advisories are accompanied by a green flag or no flag, depending on condition, and are indicated by either a voice annunciation or a chime.

NOTE: *Voice annunciations are programmed in duplicate ("stall, stall" or "altitude, altitude") and cannot be silenced while playing; pressing the MUTE button only keeps a warning from repeating.*

CWA Flags are stacked with warnings displayed on top, followed by cautions and then advisories.

AUDIBLE MESSAGE
The messages listed in the "Audible Message" column of Table 3 are all annunciated by the system in the case of a component failure.

Table 3 System Failure Warnings

Failed Component	Displayed Message	Audible Message
GPS	NO GPS	"GPS failure, GPS failure"
ADC	NO AIR DATA	"Air Data failure, Air Data failure"
AHRS	NO ATTITUDE	"Attitude failure, Attitude failure"
TCAD*	AUX SENSOR	"Auxiliary sensor failure, Auxiliary sensor failure"
WX-500*	AUX SENSOR	"Auxiliary sensor failure, Auxiliary sensor failure"
Analog Interface*	AUX SENSOR	"Auxiliary sensor failure, Auxiliary sensor failure"
Skywatch*	AUX SENSOR	"Auxiliary sensor failure, Auxiliary sensor failure"

* Refer to "FAULTS" menu on MFD to determine sensor failure.

DISPLAYS

Each integrated display unit (IDU) incorporates eight peripheral buttons (each labeled for a dedicated function) a brightness knob (left side), a menu control knob (right side), and an optional slip indicator. The peripheral buttons and slip indicator are backlit. The buttons are separated by machined "prongs" that isolate the buttons to prevent inadvertent actuation.

There are two kinds of functions: button functions and menu functions. Button functions are activated by pushing a button labeled accordingly. Menu functions are activated by pushing a button adjacent to the desired menu on the screen.

The brightness knob turns clockwise to increase screen brightness and counterclockwise to decrease screen brightness. Pushing the brightness knob while turning adjusts the button and slip indicator brightness in the same manner.

To activate a button function, push the corresponding button.

To activate a menu function, push the button that corresponds with the menu. To display menus, push the Menu button.

When a menu appears in the lower right corner of the screen, it is controlled with the right-hand knob. Turn the knob to scroll to the desired menu item, letter, or number, and then push to select.

If there are no menus shown on the PFD screen, turning the control knob sets the barometric pressure for the altimeter. Pushing it has no function. Likewise, turning the control knob on the MFD when there are no menus shown sets the scale of the map. Pushing the knob on the MFD instantly brings up a reversionary PFD screen; pushing it again returns to the navigation display.

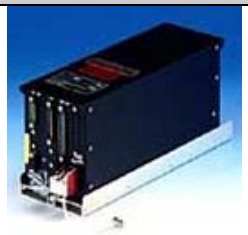
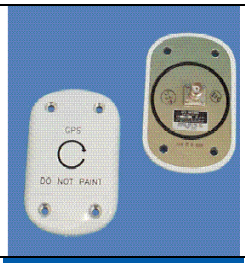
Once inside the menu structure, the top left button (adjacent to the BACK menu) always takes you back one step in the menu structure. The top right button (adjacent to the EXIT menu) always takes you completely out of the menus.

SYSTEM COMPONENTS AND SPECIFICATIONS

The table below describes each component of the system along with physical and electrical specifications. The components are grouped according to how they are packaged

Table 4 System Components and Specifications

Component	Description	Part No.	Specifications		
			Dimensions	Weight	Power
	Integrated Display Unit (IDU)	401-045500-0101	6.30”w 5.50”h 3.25”d	4.6 lbs.	11-30VDC 1.4 Amps @ 28VDC 2.8 Amps @ 14VDC
	Slip Indicator (IDU)	310-045600-01	3.00”w 0.75”h 0.40”d	0.1 lbs.	N/A
	Non-slip bezel (IDU)	146-045520-01	3.00”w 0.75”h 0.40”d	0.1 lbs.	N/A
	Tray Assembly	401-045515-02 401-045515-03 401-045515-04 401-045515-05	6.25”w 5.50”h 5.22”d	1.4 lbs.	N/A
	System Config. Card (SCC)	310-045626-01 310-045628-01 310-045629-01 310-045630-01 310-045625-01	1.75”w 1.25”h	0.1 lbs.	5 VDC
	Air Data Computer (ADC)	962830A-1-S-8 962830A-2-S-8 962830A-3-S-8	3.4”w 3.5”h 6.3”d	2.8 lbs.	14-28 VDC 1.3 Amps
	Attitude Heading and Reference System (AHRS) Crossbow (Optional)	8350-0062-xx	4.66”w 4.863”h 5.909”d	4.6 lbs	9-30 VDC 0.14 Amps

Component	Description	Part No.	Specifications		
			Dimensions	Weight	Power
	Attitude Heading and Reference System (AHRS) Litef (Optional)	142185-1xxx 142185-2xxx 142185-3xxx	4.17”w 4.96”h 10.95”d	8.7 lbs	28 VDC 1.7 Amps
	Global Positioning System (GPS/ WAAS)	84100-02-03xx	4.13”w 1.60”h 6.50”d	0.8 lbs.	12-28 VDC 0.25 Amps @ 28VDC 0.5 Amps @ 14VDC
	GPS Antenna (Optional)	Aero 81194	3.0”w 0.5”h 4.7”d	0.375 lbs.	5 VDC (from sensor)
	GPS Antenna (Optional)	Comant CI 405-100	2.7”w 0.7”h 4.3”d	0.3 lbs.	5VDC (from sensor)
	GPS/Comm Antenna (Optional)	Comant CI 2480-204	2.6”w 17.0”h 4.5”d	0.6 lbs.	5VDC (from sensor)
	Analog Interface Unit (AIU-1) (Optional)	453-7000	5.05”w 3.08”h 8.12”d	2.2lbs.	10-34VDC 0.5 Amps

NOTE: *Small parts and electrical components required for installation that are not specifically called out in the parts list, shall meet the requirements for aerospace use as “acceptable parts” or “standard parts”. Selection of these parts shall be in accordance with guidance provided in FAA Advisory Circular 20-62D, dated 5/24/96 (or later revision).*

IDU AND TRAY ENVIRONMENTAL QUALIFICATION

The IDU meets the following environmental testing requirements from DO-160D:

Table 5 IDU Environmental Qualifications

Sec.	*Condition*	*Cat.*	*Test Category Description*	*Notes*
4.0	Temperature and Altitude	F2	Equipment intended for installation in non-pressurized and non-controlled temperature locations in an aircraft that is operated at altitudes up to 55,000 ft (16,800 m) MSL.	Cat. F1 (-20°C) for Operating Low Temp. +75°C for Short-Time Operating High Temp. Cat. V (30 minutes) for loss of cooling.
5.0	Temperature Variation	B	Equipment in non-temperature-controlled or partially temperature-controlled internal section of the aircraft.	
6.0	Humidity	A	Equipment intended for installation in civil aircraft, non-civil transport aircraft and other classes, within environmentally controlled compartments of aircraft in which the severe humidity environment is not normally encountered.	
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	Level 5 for Crash Safety Sustained Test
8.0	Vibration	T + R	T - (Fixed-Wing) Demonstrates performance at higher vibration levels and after long-term vibration exposure. It also demonstrates performance during high level - short duration vibration. R - (Helicopter w/Known Frequencies) Demonstrates performance at higher vibration levels and after long term vibration exposure when the specific rotor frequencies are known.	See environmental qualification form for category R frequencies tested.
10.0	Waterproofness	W	Equipment that is installed in locations where it is subject to falling water (generally due to condensation) in the course of normal operations	
15.0	Magnetic Effect	Z	Magnetic deflection distance less that 0.3m.	
16.0	Power Input	B	Equipment intended for use on aircraft electrical systems supplied by engine-driven alternator/rectifiers, or dc generators where a battery of significant capacity is floating on the dc bus at all times.	
17.0	Voltage Spike	A	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
18.0	Audio Frequency Conducted Susceptibility-Power Inputs	B	Equipment intended for use on aircraft electrical systems supplied by engine-driven alternator/rectifiers, or dc generators where a battery of significant capacity is floating on the dc bus at all times.	
19.0	Induced Signal Susceptibility	Z	Equipment intended primarily for operation in systems where interference-free operation is required.	
20.0	Radio Frequency Susceptibility	W	Equipment tested to test levels for bench testing to show compliance to interim HIRF rules.	
21.0	Emission of Radio Frequency Energy	M	Equipment and interconnecting wiring located in areas where apertures are EM significant and not directly in view of the radio receiver's antenna. This category may be suitable for equipment and associated interconnecting wiring located in the passenger cabin or cockpit of a transport aircraft.	
22.0	Lightning Induced Transient Susceptibility	A3G33	Equipment interconnected with wiring installed within airframes or airframe sections where apertures, not structural resistance, are the main source of induced transients as would be the case in all-metal airframes, airframes composed of metal framework and composite skin panels or carbon fiber composite airframes whose major surface areas have been protected with metal meshes or foils. Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	Cat. A pin injection tests. Cat. G cable bundle single stroke, multiple stroke, and multiple burst tests.
25.0	Electrostatic Discharge	A	Electronic equipment that is installed repaired or operated in an aerospace environment.	

IDU AND TRAY TSO APPLICABILITY

The IDU meets the following TSO requirements:

Table 6 IDU TSO Applicability

TSO	Title	MOPS
TSO-C2d	Airspeed Instruments	SAE AS8019
TSO-C4c	Bank and Pitch Instruments	SAE AS396
TSO-C6d	Direction Instrument, Magnetic (Gyroscopically Stabilized)	SAE AS8013
TSO-C8d	Vertical Velocity Instruments (Rate-Of-Climb)	SAE AS8016
TSO-C10b	Altimeter, Pressure Actuated, Sensitive Type	SAE AS392C
TSO-C34e	ILS Glide Slope Receiving Equipment Operating Within the Radio Frequency Range of 328.6-335.4 MHz (partial)	RTCA/DO-192
TSO-C35d	Airborne Radio Marker Receiving Equipment	RTCA/DO-143
TSO-C36e	Airborne ILS Localizer Receiving Equipment Operating Within the Radio Frequency Range of 108-117.9 MHz	RTCA/DO-195
TSO-C40c	VOR Receiving Equipment Operating Within the Radio Frequency Range of 108-117.9 MHz	RTCA/DO-196
TSO-C41d	Airborne Automatic Direction Finding (ADF) Equipment	RTCA/DO-179
TSO-C52b	Flight Director Equipment	SAE AS8008
TSO-C87	Airborne Low-Range Radio Altimeter	RTCA/DO-155
TSO-C110a	Airborne Passive Thunderstorm Equipment	RTCA/DO-191
TSO-C113	Airborne Multipurpose Electronic Displays	SAE AS8034
TSO-C146a	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)	RTCA/DO-229C (Class Gamma-1)
TSO-C147	Traffic Advisory System	RTCA/DO-197A
TSO-C151b	Terrain Awareness and Warning System	RTCA/DO-161A

The Shadin ADC, Crossbow AHRS, FreeFlight GPS/WAAS and AIU environmental test requirements and TSO applicability are located in their respective installation manuals.

ACRONYMS AND ABBREVIATIONS

The following abbreviations and acronyms are used extensively throughout this document and in the system's user interface.

AC	Advisory Circular
AD	Airworthiness Directive
ADC	Air Data Computer
ADS-B	Automatic Dependent Surveillance-Broadcast
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AMLCD	Active Matrix Liquid Crystal Display
ANSI	American National Standards Institute
APV	Approach with Vertical Guidance
ARINC	Aeronautical Radio, Inc.
ARP	SAE Aerospace Recommended Practice
AS	SAE Aerospace Standard
ATA	AT Attachment (hard disk storage interface)
ATC	Air Traffic Control
CDI	Course Deviation Indicator
CDTI	Cockpit Display of Traffic Information
CFS	Chelton Flight Systems
CRC	Cyclic Redundancy Check
DA	Decision Altitude
DAICD	Digital Aeronautical Information CD
DEM	Digital Elevation Model
DH	Decision Height
DL	Data Link
DME	Distance Measuring Equipment
DO	RTCA Document
DOD	Department of Defense
DOF	Digital Obstruction File
DP	Departure Procedure
DR	Dead Reckoning or Defect Report
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Proximity Warning System
EIA	Electronics Industry Association
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FAWP	Final Approach Waypoint - same as FAF
FDE	Fault Detection and Exclusion
FIFO	"First in, First out"
FIS	Flight Information Service
FIS-B	Flight Information Service-Broadcast
FL	Flight Level
FLTA	Forward Looking Terrain Awareness
FMS	Flight Management System
FPE	Floating Point Emulation
FPM	Feet per Minute
FSD	Full Scale Deflection
FTE	Flight Technical Error
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPH	Gallons per Hour
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HFOM	Horizontal Figure of Merit
HPL	Horizontal Protection Level
HSI	Horizontal Situation Indicator
HUL	Horizontal Uncertainty Limit
IAP	Instrument Approach Procedure, also Initial Approach Point
IAWP	Initial Approach Waypoint – same as IAP
ICAO	International Civil Aviation Organization
ID	Identity or Identification
IDU	Integrated Display Unit
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
IO	Input/Output
IPV	Instrument Procedure with Vertical Guidance
JAD	Jeppesen Aviation Database
KB	Kilobyte
KIAS	Knots Indicated Airspeed
KT	Knot – Nautical Mile per Hour
KTAS	Knots True Airspeed
LDA	Localizer – type Directional Aid
LNAV	Lateral Navigation
LOC	Localizer
LRU	Line Replaceable Unit
MAHP	Missed Approach Holding Point
MAHWP	Missed Approach Holding Waypoint – same as MAHP
MAP	Missed Approach Point
MAWP	Missed Approach Waypoint – same as MAP
MB	Megabyte
MDA	Minimum Decent Altitude
MFD	Multifunction Display (an IDU with software for showing multiple display screens)
MM	Middle Marker
MOPS	Minimum Operational Performance Standard
MLS	Mean Sea Level
MTBF	Mean Time Between Failures
NACO	National Aeronautical Charting Office
NAS	U.S. National Airspace System
NASA	National Aeronautics and Space Administration
NED	National Elevation Dataset
NIMA	National Imagery and Mapping Agency
ND	Navigation Display
NDB	Nondirectional Beacon
NM	Nautical Mile
NPA	Non-Precision Approach
OBS	Omnibearing Selector
OM	Outer Marker
OT	Other Traffic (Traffic Function)
PA	Proximate Advisory (Traffic Function)
PDA	Premature Descent Alert
PFD	Primary Flight Display (the display screen showing primary instrumentation – can also refer to the primary IDU with software that only shows primary instrumentation)
PFDE	Predicted Fault Detection and Exclusion

PLI	Pitch Limit Indicator
RA	Resolution Advisory (Traffic Function)
RAM	Random Access Memory
RMI	Radio Magnetic Indicator
RNAV	Area Navigation
RNP	Required Navigation Performance
RTCA	Radio Telephone Commission for Aeronautics
SA	Selective Availability
SAE	Society of Automotive Engineers
SCFM	Square Cubic Feet per Minute
SRTM	Shuttle Radar Topographical Mission
STAR	Standard Terminal Arrival Routes
STC	Supplemental Type Certificate
SUA	Special Use Airspace
SV	Service Vehicle
TA	Traffic Advisory (Traffic Function)
TAS	Traffic Advisory System
TAWS	Terrain Awareness and Warning System
TCAD	Traffic Collision Alert Device
TCAS	Traffic Collision Alert System
TERPS	Terminal Instrument Procedures
TCH	Threshold Crossing Height
TD	Traffic Display
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast
TSO	Technical Standard Order
UART	Universal Asynchronous Receiver Transmitter
USGS	United States Geological Survey
UTC	Universal Time Coordinated
VAL	Vertical Alert Limit
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Radio
VPL	Vertical Protection Level
VSI	Vertical Speed Indicator
VTF	Vectors to Final
WAAS	Wide Area Augmentation System
WED	Wulfsberg Electronics Division
WGS84	World Geodetic System 1984

Chapter 2

System Installation

A successful installation should begin with careful consideration and planning of mounting locations, cable routing, and any associated airframe modifications that may be required.

WARNING!
It is critically important for you to read this installation guide completely and thoroughly before starting component installation and wiring.

LIMITATIONS AND NOTES

The following limitations and notes must be noted by the installer prior to start of installation:

NOTE: *Installation of the PFD and/or MFD should not change the primary structure of the instrument panel. Any changes to the primary structure will require additional FAA approval (see Task 3 for additional detail).*

NOTE: *Installation of new electrical backup indicators is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. Replacement of the original aircraft pneumatic indicators or installation of new electrical backup indicators must be performed under a separate FAA installation approval (see Task 7 for additional detail).*

NOTE: *Ensure that the ADC is not the lowest point in the pitot and static system, to reduce the chances of collecting moisture or water in it. If the ADC cannot be located above the lowest point in the pitot or static system, then a water trap and drain must be installed at the lowest point. Additional field approval and documentation in the Instruction for Continued Airworthiness must be made to inform maintenance personnel of the location and maintenance requirements of the new drain. STC SA02203AK, STC SR02209AK, or STC SA02220AK do not contain approval for new static drains or water traps (see Task 9 for additional detail).*

NOTE: *Installation of an ARINC-429 ADC is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. The ARINC-429 ADC installation must be previously existing or performed under a separate FAA installation approval (see Task 9 for additional detail).*

NOTE: *If there is no existing fuel flow transducer and no applicable fuel flow transducer STC, the EFIS system fuel flow function must be disabled using the aircraft limits (see Task 13 for additional detail).*

NOTE: *Installation of an ARINC-429 AHRS is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. The ARINC-429 AHRS installation must be previously existing or performed under a separate FAA installation approval (see Task 17 for additional detail).*

NOTE: *Installation of the Litef LCR-93 AHRS is for attitude and heading reference to the EFIS only. Using the AHRS as an attitude or heading source for external systems such as an autopilot are not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. Autopilot or other system interfacing must be previously existing or performed under a separate FAA installation approval (see Appendix D for additional detail).*

The following list of ARINC-429 sensors may be used provided that the ARINC-429 interface is properly tested during ground and flight functional tests as described in Chapter 6 and 7 respectively:

AHRS	Manufacturer
LCR-92	Litef

ADC	Manufacturer
ADC-6000	Shadin
9B-81010-22	Innovative Solutions and Support (IS&S)
9B-81103-1	Innovative Solutions and Support (IS&S)

WARNING!
Failure to program the EFIS for aircraft specific limits prior to first flight may cause unsafe flight conditions. Consult with the operator of the aircraft during programming of all limits (see Chapter 5, IDU Limits Programming for additional detail).

PRE-INSTALLATION INFORMATION

Always follow good avionics installation practices per FAA Advisory Circulars 43.13-1B, 43.13-2A, and AC 23-1311-1A or later FAA approved revisions of these documents.

Detailed wiring diagrams are found on the current revision of drawings:

702-045250	EFIS IDU Interface
702-045251	Aircraft System Interface

Additional sensor installation instructions can be found in the current revision of the following manufacturer's documents:

7410-0001-[ ]	Crossbow AHRS500GA Installation Manual
84143-01	FreeFlight GPS Equipment Installation Manual
IM2830-AYS8	Shadin ADC2000 Quickstart Installation Manual
IM1201	Shadin OAT Probe Assembly Installation Manual
570-7000	AIU-1 Analog Interface Unit Installation Manual
142185-0000-840	Litef LCR-93 Installation/Maintenance Instructions

Installation of the EFIS system uses one or more of the following installation kits:

149-045264-01 PFD

SEQ	QTY	REFERENCE	DESCRIPTION	ITEM	MANUFACTURER	CHELTON P/N
1	1	CON37	CON 37 PIN-F	P2	GLENAIR	D38999/26FD35SN
2	1	BACK37	BACKSHELL, 37 PIN		GLENAIR	M85049/19-15N03
3	1	CON66	CON 66 PIN-F	P3	GLENAIR	D38999/26FF35SN
4	1	BACK66	BACKSHELL, 66 PIN		GLENAIR	M85049/19-19N07
5	2	TOGSWITCH	SWITCH, SPST	S9504	C&K	130-045640
6	1	KB01	KEYBOARD PLUG MOUNT		CHELTON	146-045641
7	1	CON6	CON 6-PIN MINI-DIN, KEYBOARD	P7	SINGATRON	129-245633
8	1	PLACARD	TAWS INHIBIT		CHELTON	156-045335
9	1	CON15	CON DB-15 FEMALE, AHRS	P9513	POSITRONICS	129-245632

149-045264-02 MFD

SEQ	QTY	REFERENCE	DESCRIPTION	ITEM	MANUFACTURER	CHELTON P/N
1	1	CON37	CON 37 PIN-F	P2	GLENAIR	D38999/26FD35SN
2	1	BACK37	BACKSHELL, 37 PIN		GLENAIR	M85049/19-15N03
3	2	CON66	CON 66 PIN-F	P3/P4	GLENAIR	D38999/26FF35SN
4	2	BACK66	BACKSHELL, 66 PIN		GLENAIR	M85049/19-19N07

149-045264-03 Dual Sensor Option

SEQ	QTY	REFERENCE	DESCRIPTION	ITEM	MANUFACTURER	CHELTON P/N
1	1	RS12-020	REMOTE SWITCH	M9530	NAT	RS12-020
2	3	TOGSWITCH	SWITCH, SPST	S9505-S9507	C&K	130-045640
3	1	PLACARD	AHRS 1/AHRS 2		CHELTON	156-045338
4	1	PLACARD	ADC 1/ADC 2		CHELTON	156-045337
5	1	PLACARD	GPS 1/GPS 2		CHELTON	156-045339
6	1	RS12-IKC	REMOTE SWITCH, INSTALL KIT	P9530	NAT	RS12-IKC
7	1	CON15	CON DB-15 FEMALE, AHRS	P9513	POSITRONICS	129-245632

149-045264-04 Additional IO Option for PFD

SEQ	QTY	REFERENCE	DESCRIPTION	ITEM	MANUFACTURER	CHELTON P/N
1	1	CON55	CON 55 PIN-F	P5	GLENAIR	D38999/26FE35SN
2	1	BACK55	BACKSHELL, 55 PIN		GLENAIR	M85049/19-17N06

149-045264-05 Additional IO Option for MFD

SEQ	QTY	REFERENCE	DESCRIPTION	ITEM	MANUFACTURER	CHELTON P/N
1	2	CON55	CON 55 PIN-F	P5/P6	GLENAIR	D38999/26FE35SN
2	2	BACK55	BACKSHELL, 55 PIN		GLENAIR	M85049/19-17N06

Follow the installation procedure in this chapter as it is presented for a successful installation. Read the entire chapter before beginning the procedure. Perform the post installation checkout before closing the work area in case problems occur.

Complete an electrical load analysis on the aircraft prior to starting modification to ensure the aircraft has the ability to carry the EFIS load per AC43.13-1B, Chapter 11. Refer to Table 4 for the power consumption of each component. Record the aircraft load on FAA Form 337. Upon completion, identify system configuration and location of equipment on FAA Form 337.

CABLING TERMINATION

1. GENERAL

a. Terminate all individual cable shields which are not "dead ended" using a solder sleeve (M83519/2 or equivalent) or optionally the braid pull-out method. Use the smallest solder sleeve that will fit over the cable shield and the braid pigtail.

b. The shield pigtail may be either a wire segment or another small braid segment. Wire segments are used when the cable shield is terminated to a connector contact or a terminal lug. Braid segments are used when the cable shield terminates at a backshell or EMI spigot or split support ring used to terminate a braid sock. ZAP assemblies with multiple terminations may use either wire pigtails, braid pigtails or a combination of both.

c. For backshell shield terminations, the individual cable shield shall be terminated at the end of the cable maintaining the minimum length of unshielded conductors with the shield pigtail installed at the back end. The solder sleeve may end up inside the backshell depending on the length of the unshielded portion of the cable.

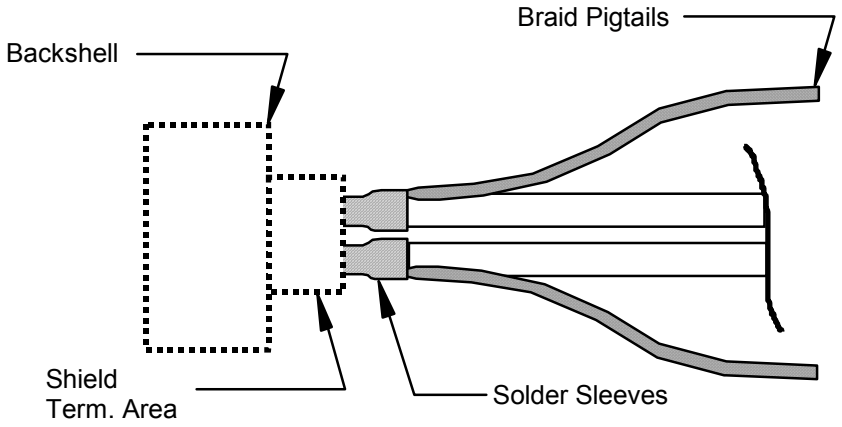


Figure 2: Solder Sleeve Assembly

2. SOLDER SLEEVE ASSEMBLY

a. Remove the outer jacket using a thermal stripper or other suitable means, exposing 0.25 to 0.38 inch of shield braid.

(1) When using a suitable tool other than a thermal stripper to remove jacket, score jacket lightly and bend cable to complete jacket separation. Do not cut completely through cable jacket.

CAUTION
Cutting through the cable jacket may result in damage to shield.

b. Push the solder sleeve over the exposed shield braid so solder sleeve shall be approximately centered over the exposed shield braid.
   (1) To avoid heat concentration which might split or otherwise damage the solder sleeve, the end of the shield ground wire insulation, if not preinstalled, should be positioned approximately even with the inner edge of the seal ring.
   (2) Maintain the relative position of the solder sleeve, shield ground wire and shield braid during assembly.

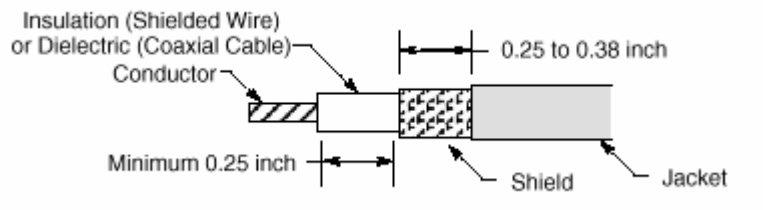


Figure 3: Wire Termination

c. Use tinned copper braid Alpha P/N 1223 (3/64 inch) or equivalent for pigtail. Lap pigtail braid or wire segment with wire shield and place solder sleeve over assembly.

d. Shrink the solder sleeve in accordance using infrared or hot air heaters. Apply the heat uniformly, periodically rotating the solder sleeve during the heating process. Do not allow the infrared or hot air heater to touch the solder sleeve or wire during the heating process (touching of the heating guard is acceptable).

e. Inspect for conformance to criteria for installed solder sleeves per the following:
   (1) No appearance of the solder preform ring will remain.
   (2) In the case of solder sleeves with indicator rings the following also applies: It is necessary that the indicator ring has completely disappeared or melted.

NOTE: If the process continually results in less than 100 percent melting of the indicator ring there may be a problem with the process which should be corrected before further processing.

– If infrared heating is used, the problem is usually caused by a dirty reflector.
– If hot air is used, the sleeve may not be centered in the hot air reflector.

(3) The shield ground wire shall be approximately centered in the melted area.
(4) Preformed solder ring inserts are to melt and flow along the shield ground wire leads and shield.
(5) A minimum 0.125 inch fillet length is visible under a maximum power of 4X magnification along the shield ground wire lead and shield junction on at least one side of the shield ground wire. This requirement also applies to each shield ground wire of a multiple shield ground wire termination.
(6) Browning or darkening of the sleeve is acceptable unless this condition inhibits visibility of the solder termination.
(7) The materials must not be split, charred, or otherwise damaged to any extent that that would compromise the insulating integrity of the sleeve.
(8) Inserts are to melt and flow around the circumference of the cable between the cable jacket and the insulation sleeve to prevent solder from flowing out of the work area.
(9) The melted insert rings must not obstruct visual inspection of the solder joint.
(10) A maximum of 1/2 inch wicking up the shield ground wire (measured from the shield ground wire end of the sleeve) is allowed.

3. OPTIONAL SHIELD PULL-OUT METHOD

a. Do not use this procedure for a shield that has flat conductor braid strands.

b. Remove the cable outer jacket to the point of breakout.

c. Using a non–metallic awl or similar tool, start a small hole in the shield braid approximately 0.5 inch from end of outer jacket by spreading the shield carriers slightly.

d. Push the shield braid back on the wire(s) to cause it to bunch.

e. Widen the hole in the shielding by alternately pushing shield carriers back in each direction.

f. As the hole enlarges, start bending the wire(s) slightly to allow shield carriers to be worked down over the bent wire(s) until the

wire(s) can be pulled through the opening. During this operation, avoid damage to braid and conductor insulation.
(1) Do not overstress individual shield strands causing breakage.
(2) Do not subject the conductors to a bend radius less than 3 times the insulation diameter.

g. Work the bunched shielding back down the wire and straighten the shield ground wire to its full length.

h. Cut the shield ground wire to a maximum length of 2.0 inches.

i. Protect shield breakout area using M23053/5 sleeving.

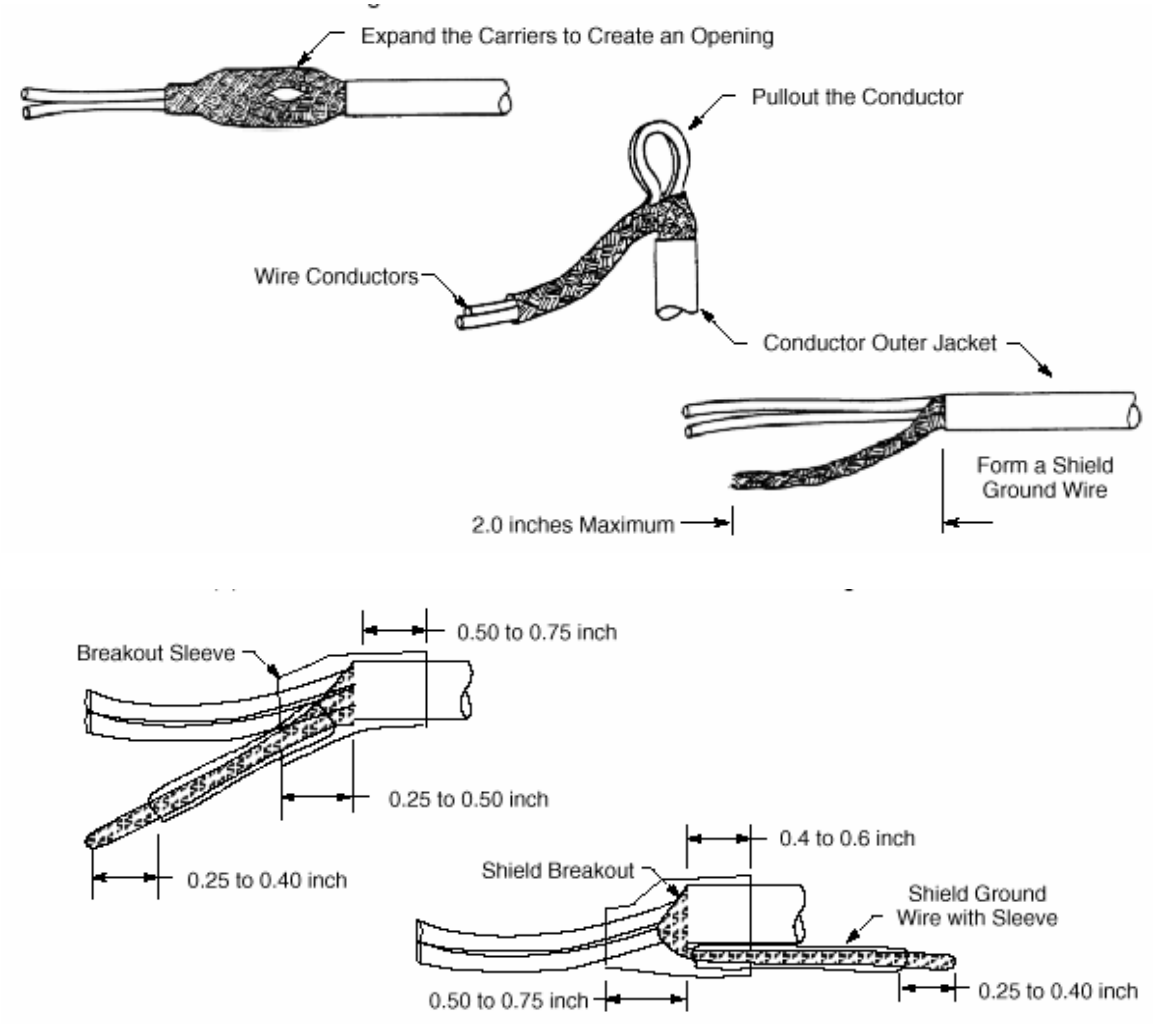


Figure 4: Shield Pull Out Method

4. BACKSHELL TERMINATION (M85049/19 TYPE)

a. Attach backshell body to connector, properly clocking backshell and tighten backshell coupling ring slightly beyond hand tight or torque if required.

b. Dress wires in backshell body and position cover. Do not pinch wires between backshell body and cover.

c. Route braid pigtails back over backshell body EMI cone and fold braid pigtails evenly over the taper of the EMI cone. Trim braid pigtails to prevent braid from lying on threads. Do not let braid ends cut from shield, fall into connector.

d. Slide rear EMI cone over the front EMI cone, wedging the shield pigtails between the two tapered surfaces.

e. Tighten backshell strain relief to hold braid strands securely. During the tightening operations, the shield pigtails may move slightly. This is acceptable as long as the pigtails do not lie on top of each other.

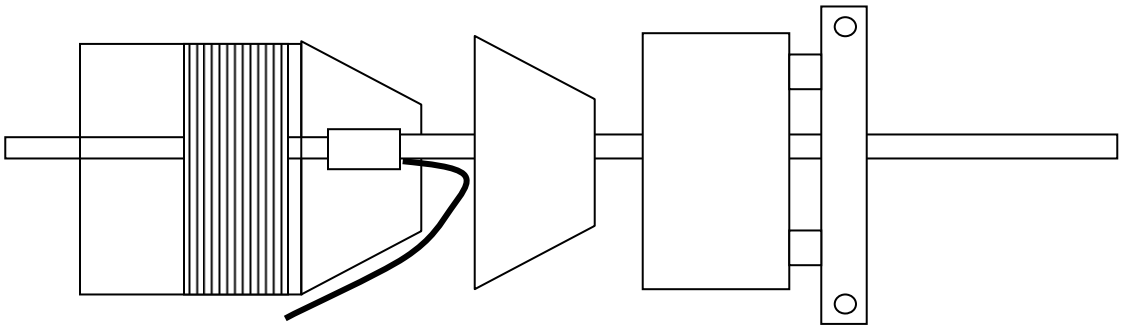


Figure 5: Shield Routing

5. AHRS CONNECTION

a. AHRS cable connection consists of the following:
Positronics DB-15 female crimp connector
Positronics crimp sockets
Positronics EMI/RFI straight backshell

b. Terminate shielded cable per step 3 or 4. Ensure exposed wire is not more than two inches from shield.

c. Run shield pigtail to backshell termination screw as shown below.

d. Wrap all wires with anti-chaff tape or equivalent at backshell clamp and secure wires.

e. Install backshell cover and secure with four screws.

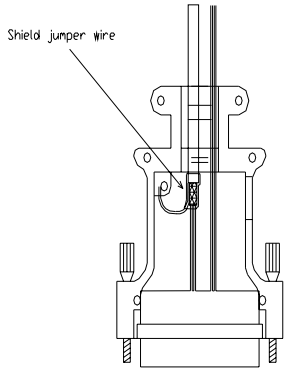


Figure 6: AHRS Wire Termination

INSTALLATION OVERVIEW

Installation will typically follow these steps, which are explained in detail later in this chapter:

1. Perform a pre-mod avionics system check to verify that all systems are functioning properly.

2. Perform a pre-mod pitot/static leak check to verify that the pitot and static plumbing are secure.

3. Remove the pilot's and co-pilot's (if applicable) instrument panel.

4. Modify the pilot's and Co-Pilot's (if applicable) instrument panels.

5. Install the ADC unit(s).

6. Install pitot and static plumbing.

7. Install the Temperature Probe(s).

8. Install the Fuel Flow Transducer.

9. Install the GPS unit(s).

10. Install GPS antenna(s).

11. Temporarily install the AHRS sensor(s).

12. Test magnetic properties around AHRS to determine acceptable location.

13. Finalize the AHRS installation.

14. Perform a Weight and Balance.

15. Configure the EFIS software (see Chapter 5).

16. Ground Functional Test (see Chapter 6).

17. Flight Functional Test (see Chapter 7).

INSTALL THE EFIS SYSTEM

Task 1. Pre-mod Avionics Systems Check

Perform a pre-modification of all avionics systems on aircraft. Verify that all systems are functioning properly in accordance with the applicable aircraft maintenance manuals. If any discrepancies are noted, generate the appropriate paper work and record these discrepancies.

Task 2. Pre-mod Pitot/Static Leak Test

A Pitot and Static Leak test is performed to verify that the pitot and static lines and fittings are secure so the airspeed (pitot) and altimeter (static) indications will be accurate.

Perform a pre-maintenance static leak test in accordance with FAR § 43 Appendix E (a) (2) or applicable aircraft maintenance manuals and record the results. In the event of excessive leakage, leaks should be found and corrected prior to continuing the installation.

Static leak rate _____FPM at _____FT.

Perform a pre-maintenance pitot leak in accordance with applicable aircraft maintenance manuals and record the results.

Pitot leak rate _____KTS per min. at _____KIAS.

Task 3. Determine the Location of the PFD, MFD, and Required Backup Instruments

The PFD and MFD must be installed within easy reach of the pilot or co-pilot. The PFD is designed to replace the original instruments that were installed in front of the pilot. The aircraft yoke should not interfere with the sighting of the PFD or MFD.

NOTE: *Installation of the PFD and/or MFD should not change the primary structure of the instrument panel. Any changes to the primary structure will require additional FAA approval.*

The required mounting location for the PFD is:

- Between eye-level and 40° below eye-level vertically
- Not to exceed 12 inches laterally from center of Pilot's seat to center of PFD.

The required mounting location for the MFD is:

- Between eye-level and 40° below eye-level vertically
- ±70° laterally

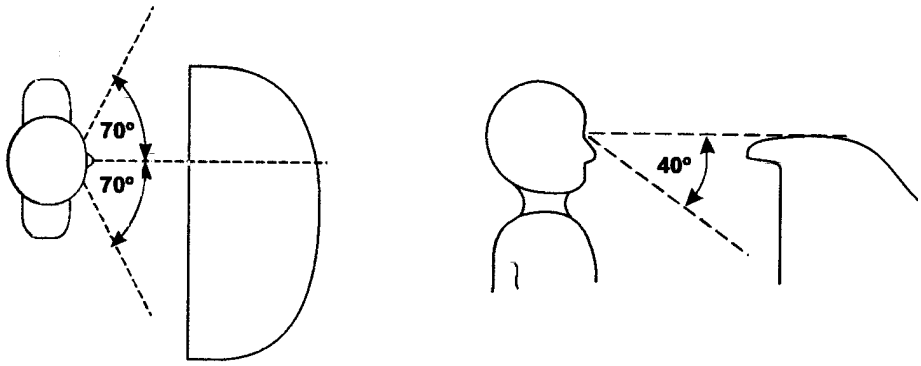


Figure 7: Optimal IDU Location

NOTE: *Helicopter installation requirements are located in the Appendices at the end of this manual.*

The pilot's view of the PFD and MFD screens must not be obscured by aircraft structure or controls. The following photographs show representative panel installations:

Figure 8: Twin Engine Cabin Class, Horizontal Panel

Figure 9: Twin Engine, MFD in Radio Stack

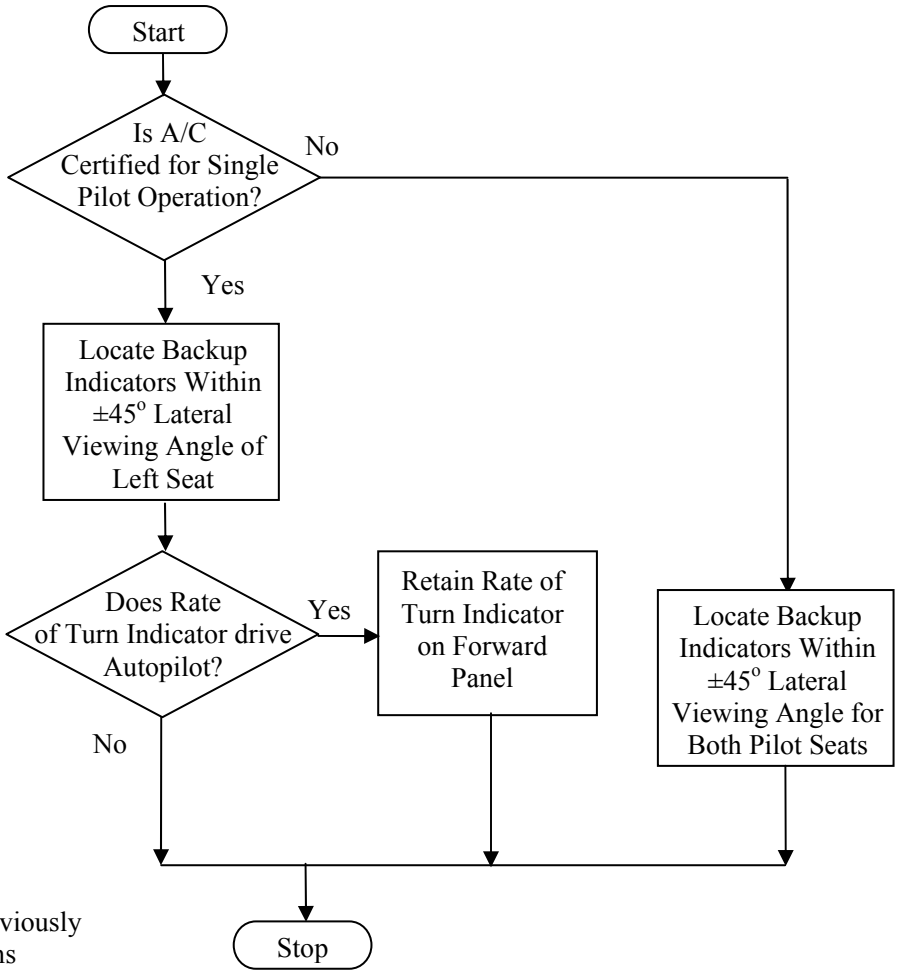
Figure 10: Single Engine, Horizontal Panel

Figure 11: Single Engine, Vertical Panel

The CFS EFIS installation requires the following backup instruments:

- attitude indicator
- standard airspeed indicator
- standard altimeter
- directional source (wet compass, etc.)

Use the following flow chart to determine placement of the backup instruments.



In accordance with:
AC 23-1311 and previously approved installations

Note: For guidance on Rate of Turn Indicator, refer to AC 91-75

Figure 12: Backup Instrument Placement Flowchart

Panel Notes

1. New panel thickness shall be same as original
2. Existing instruments shall be installed with original hardware where practical. Replace any defective hardware with same type if required
3. All additional mounting hardware is supplied by the installer
4. Refer to each manufacturer's installation manual for additional installation guidance on all instruments

5. Unless otherwise specified, maintain 0.25” minimum distance between instruments and 0.375” from instrument to edge of instrument panel
6. Use existing instrument panel mounting holes to install new panels
7. Shim all equipment as required
8. Use original supporting structure when reinstalling existing equipment
9. Trim new panel as required at installation to match existing instrument panel contour
10. Chemical conversion coat all aluminum parts per MIL-C-5541, Class 1A and finish with powder coating or epoxy primer per MIL-P-23377, Type 1 as required. Paint or powder coat to match existing instrument panel.
11. PFD/MFD configuration may vary depending on aircraft configuration. Maintain 0.50” minimum edge distance all around.

Multiple IDU Installation

In most applications, the PFD will be located near the top of the instrument panel, below the glare shield, and directly in front of the pilot. The IDU utilizes back-lit, active matrix, LCD technology and, like all LCD’s, will exhibit a certain amount of graphic degradation as viewing angles increase.

The IDUs can be mounted vertically (PFD over MFD on one panel), horizontally (PFD next to MFD on one panel), or singular (PFD on Pilot’s panel, MFD on Co-Pilot’ss panel or radio stack). When PFD is installed above the MFD, ensure the line of site on both displays is not blocked.

Single IDU Installation

In a single IDU installation, the IDU is programmed to display both the PFD page and the navigation page. The original flight instruments (altimeter, airspeed indicator, attitude indicator, vertical speed indicator, directional gyro, and turn and bank indicator) must maintain their current positions on the Pilot’s’ instrument panel. The IDU is located at another location (radio stack, Co-Pilot’s panel, etc.) where the pilot can monitor the information, but is not considered part of the primary flight instruments. The software configuration card (SCC) mounted in the tray will be a number 0 (zero).

In a single IDU installation, the IDU must be connected to drive a CDI or HSI within the primary field of view of the pilot. Therefore, installation of an AIU is mandatory in a single IDU installation. A navigation source annunciator must be mounted on or near each

affected CDI or HSI if the CDI or HSI is capable of receiving signals from other navigation equipment. Refer to AC 20-138 or AC 20-130A for guidance.

Cooling

External cooling is not required, but is recommended to increase the operating life of the equipment. The IDU cooling inlet must have an adequate source of cooling air that does not exceed 130°F. As temperatures behind heavily equipped instrument panels often exceed 130°F, cooling inlet and outlet nipples are provided so that cooling air can be ducted to the IDU.

The best source of cooling air is either exterior ram air or ducting from the cool side of the aircraft's environmental control system. If these options are not available, then an avionics cooling fan can be used. If an avionics cooling fan is used, observe these guidelines:

- The cooling fan must be capable of providing at least 4SCFM of flow to each IDU.
- SCAT tubing between the cooling fan and the IDU must be 1 inch in diameter.
- If a transition is needed due to the cooling fan outlet being larger or smaller than 1 inch, mount the transition as close to the cooling fan as possible.
- The cooling path through the IDU is restrictive. As airflow takes the path of least resistance, connecting other equipment to the same source of cooling air in parallel may cause inadequate cooling air to reach the IDU. It is recommended that the cooling fan be dedicated to the IDU.
- Mount the cooling fan in an area of cool temperatures where dirt and FOD ingestion is minimal.

After completing the cooling installation, the adequacy of cooling air volume must be tested by monitoring the IDU temperature rise. Monitor the IDU temperature (Ground Maintenance Option "K," "Display Internal Temperature") and allow the temperature to stabilize. Subtract the stable temperature from the temperature at the source of the cooling air. The temperature rise must not exceed 40°C. If the temperature rise exceeds 40°C, then the IDU is receiving an inadequate volume of cooling air.

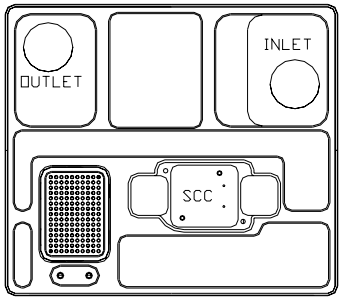


Figure 13: Cooling Inlet and Outlet Locations

WARNING!
The IDU is thermally protected. Continuous operation of the EFIS with cooling air temperature exceeding 130º or with inadequate volume of cooling air may cause the IDU to temporarily shut down due to internal thermal protection.

NOTE: *The "IDU TEMP" warning flag will be displayed at least 30 minutes prior to a thermal shutdown of the IDU. Decreasing the brightness of the IDU display will reduce internal temperature and prolong operation.*

Task 4. Remove Instrument Panel(s)

Remove pilot's instrument panel in accordance with applicable aircraft manufacturer's maintenance manuals to facilitate modification and installation of the IDU.

If applicable, remove the Co-Pilot's and or center instrument panel in accordance with applicable aircraft manufacturer's maintenance manuals to facilitate modification and installation of the IDU.

Task 5. Modify Instrument Panel(s)

Make the cutout for the IDU(s) using the drawing in Chapter 4. Use the cutting tools and technique appropriate for the material of the panel.

If new instrument panel is required, ensure panel is made of at least the same thickness and material as the original panel. Use the original

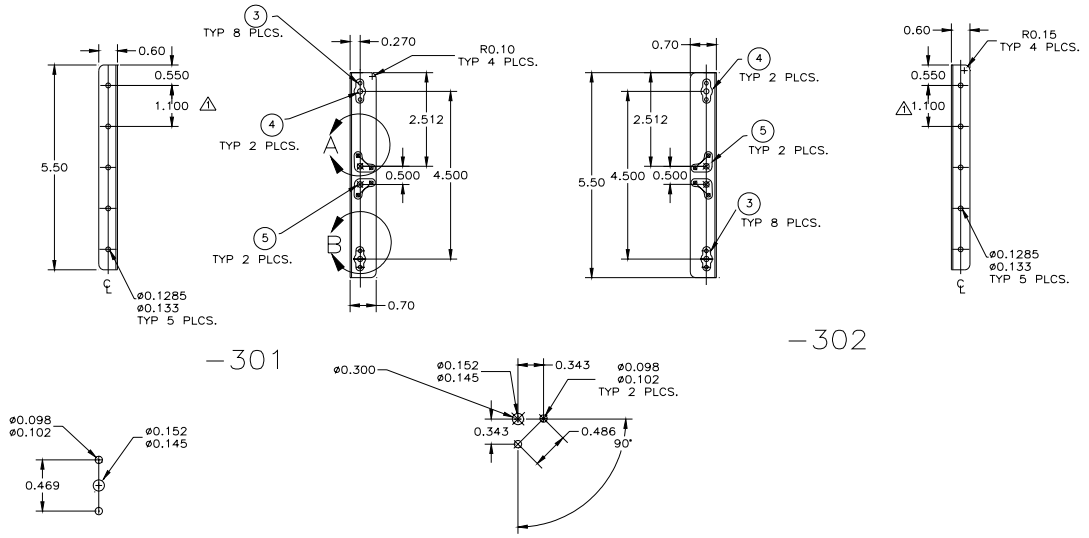
panel as a template for mounting hole placement and dimensions. IDU tray is mounted flush with the surface of the instrument panel.

NOTE: *Install all required placards on new instrument panel.*

NOTE: *Pre-existing panel lighting equipment should be re-installed. Installation of new panel lighting equipment requires a separate FAA installation approval.*

Task 6. Install IDU Mounting Tray(s)

The IDUs are mounted to the instrument panel using four mounting brackets manufactured by the installer. These brackets are made of 0.060" thick AL.ALLY-7075 T6511 extrusion or equivalent as shown below.



ITEM	DESCRIPTION	PART NUMBER
3	RIVET, 3/32	MS20426AD3
4	NUTPLATE, 6-32	MS21069L06
5	NUTPLATE, 6-32	MS21073L06

Figure 14: Typical IDU Mounting Brackets

Using the IDU Mounting tray as a template, locate, drill and countersink mounting holes for the tray mounting brackets on the instrument panel as required.

Secure the mounting brackets on the instrument panel as required to maintain a stiff location for the IDU and tray assembly. Ensure the IDU mounting tray is level with respect to the aircraft waterline.

Verify tray configuration for the installation. The back tray configurations are shown below:

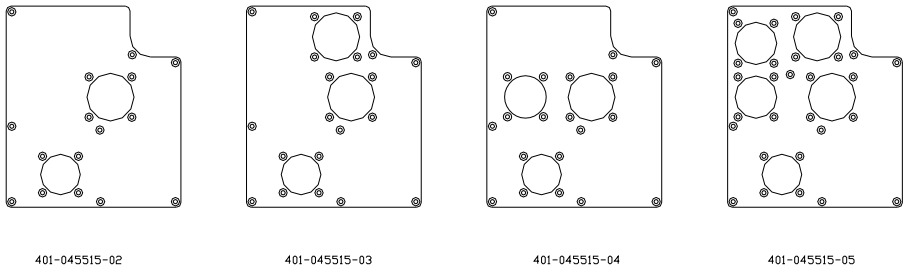


Figure 15: Tray Configuration

- The standard PFD tray is normally a -03
- The standard MFD tray is normally a -02
- A single MFD system tray is a -02
- Trays -04 and -05 are optional for installations that require additional communication interfacing (see P5/P6 pinout description, Chapter 4 Section 4.7)

Secure the IDU tray assembly to mounting brackets with eight #6 screws as required. Apply Loctite® 222 to screws for security as required.

Determine the position of each tray (PFD, MFD #1, etc.) and install the appropriate Software Configuration Card (SCC) in the tray with two 4-40x 0.25", 3/32" hex head screws supplied with card. Use Loctite® 222 to secure screws as required. The SCC association is defined as:

IDU	SCC
PFD	1
MFD No1	2
MFD No2	3
MFD No3	4
Single MFD	0

Document the location of the IDUs and trays in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

Task 7. Power Distribution

Each component of the EFSI system will require a circuit breaker as shown in drawing 702-045251. The number and location of the breakers will vary depending on the available circuit breaker panel space and installation options used.

All components of the EFIS system will be powered through an EFIS BUS as shown in drawing 702-045251. Power for the EFIS BUS will be from a suitable power source, such as the aircraft avionics bus (if available), or directly from the battery bus (if aircraft does not contain an avionics bus).

If the aircraft contains an existing avionics bus, the EFIS BUS will be protected by a circuit breaker rated to at least the sum of all breakers on the bus. If the aircraft does not contain an avionics bus, the EFIS BUS will be protected by a switched circuit breaker rated to at least the sum of all breakers on the bus.

All circuit breakers are supplied by the installer and should match the existing aircraft breakers as required. If a new circuit breaker panel is fabricated for the EFIS power bus, perform the following:

- Fabricate new panel from 2024-T3 AL ALY (QQ-A-250/5), 0.050" minimum thickness.
- Primer and paint to match existing aircraft panels.
- Bond electrically per Mil-SPEC-464.

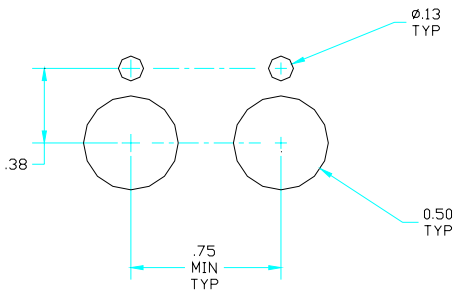


Figure 16: Typical Circuit Breaker Cutout

Electric Backup Indicators

Electric indicators (attitude, airspeed, and altitude) can be used as backup instruments provided they are powered from a separate, independent power source other than the EFIS BUS. This power source must not have any components (wires, bus bars, breakers, etc.) in common with the EFIS BUS from the generation of the power (battery, alternator, generator, etc.) to the equipment.

NOTE: *Installation of new electrical backup indicators is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. Replacement of the original aircraft pneumatic indicators or installation of new electrical backup indicators must be performed under a separate FAA installation approval.*

The installer must verify that the electric backup instruments are electrically isolated from the EFIS BUS. This verification will start from the power generation system to the backup indicator. Following is a generic example of an acceptable electrical distribution system sufficient for using electrical backup indicators, with guidelines on prohibited and allowed electrical system architectures to determine if electric backup indicators can be installed:

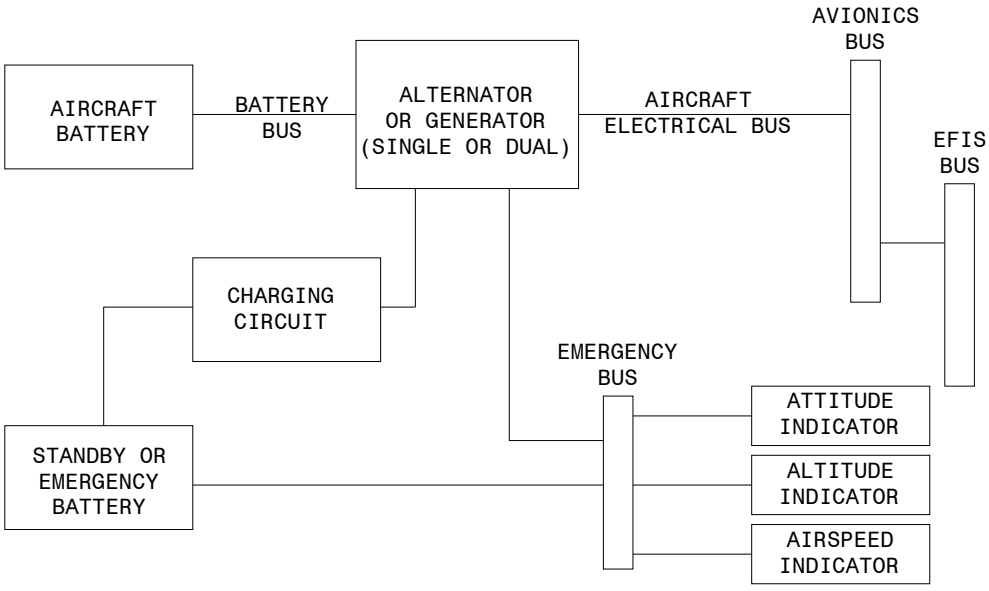


Figure 17: Example Emergency/Standby Bus Schematic (Simplified)

Prohibited
- No alternator or generator in aircraft (aircraft battery bus only)
- Battery bus fed by a single alternator or generator
- Backup indicators on same bus as EFIS

Allowed
- Backup instruments powered by a different battery than the aircraft (standby battery)
- Dual independent alternators or generators supplied by separate batteries in aircraft where EFIS is on one and the backup indicators are on another

Once the backup instrument power source has been determined, the installer must perform a load analysis on the source. This load analysis will calculate the maximum current drawn by the indicator(s) and any other equipment tied to the power source at the operating voltage to determine if the source will be able to supply the required power for a minimum of 30 minutes on its own. If the source can supply the required power for the 30 minute minimum, then the indicators can be connected to the source and used as the backup instruments.

Standby or emergency battery or dual independent electrical systems can be used for the power source of the indicator provided the battery/electrical system is installed in accordance with a prior STC approval or with a field approval per FAA Form 337. This system should include an indication to the pilot of the battery's state of charge as outlined in the manufacturer's Installation Manual or STC.

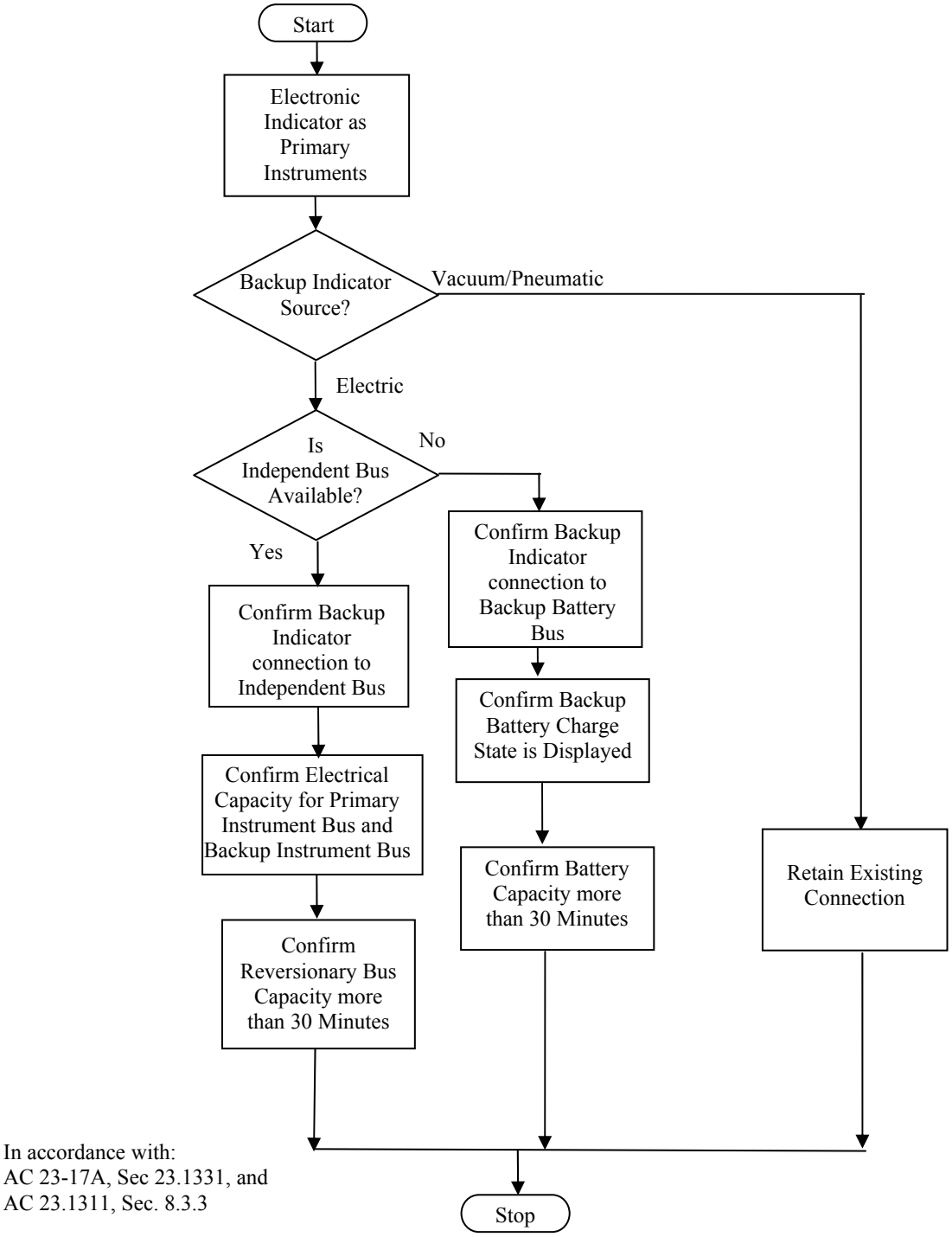


Figure 18: Backup Instrument Power Source Flowchart

Task 8. Install IDU Cable Assemblies

Fabricate the IDU cable assemblies as shown in the wiring diagrams in Chapter 4 and drawing 702-045250.

- Connect the cable assembly to J2 of the IDU Tray. Route the wiring to the circuit breaker panel. See wiring diagram in Chapter 4 and drawing 705-045250

- Connect the cable assembly to J3 of the IDU Tray. Route the wiring to the appropriate sensors. See wiring diagram in Chapter 4 and drawing 702-045250

- Connect one end of the Interconnect cable assembly to J4 of the PFD Tray and the other end to J3 of the MFD or J4 of the MFD to J3 of another MFD (if applicable). See wiring diagram in Chapter 4 and drawing 702-045250.

- Connect the cable assembly to J5 of the IDU Tray as required. Route the wiring to the appropriate sensors. See wiring diagram in Chapter 4 and drawing 702-045250.

- Connect one end of the Interconnect cable assembly to J6 of the PFD tray and the other end to J5 of the MFD or J6 of the MFD to J5 of another MFD (if applicable). See wiring diagram in Chapter 4 and drawing 702-045250 as required.

NOTE: *Ensure that a 6 to 12 inch service loop in the cable assemblies are installed behind the IDU tray as the wiring is routed.*

Task 9. Install Air Data Computer (ADC)

Shadin ADC-2000

In considering the location, keep in mind that the ADC 2000 requires signals from the OAT probe, pitot and static lines, and signals from an optional fuel flow transducer. Determine the best location of the ADC by inspecting the aircraft to minimize the amount of wire and lines needed for the installation. The ADC location must be able to structurally support the weight of the ADC and mounting hardware.

Refer to Shadin installation manual P/N IM2830-A1S8 for further information on the installation of the ADC. The recommended mounting procedures for the ADC 2000 are:

A dry temperature stable location with enough distance from motors, pulse generating equipment, relays and cables carrying high DC or AC current, to avoid interference with the low level signals of the OAT probe and fuel flow. Use an existing shelf or fabricate a new one per AC 43.13-2A, Chapter 1, §4 thru §10, and Chapter 2, §24 thru §26 as required using 0.040 inch (min) aluminum for shelf material and brackets. Reinforce shelf as necessary.

Upon determination of a suitable existing shelf, or completion of a new equipment shelf, a static load test must be performed per AC 43.13-2A, Chapter 1, §2 and §3 to determine proper load bearing and security of the equipment. The ADC mounting tray should be installed for the tests, but is not necessary as long as the mounting holes for the tray are used for the tests. A typical aircraft operating in Normal FAR 23 (CAR 3) category will require a test of the shelf as follows:

Direction of Pull	Fixed Wing		Rotorcraft	
	Load Factor	**Static Test Load** (*Load factor x ADC Weight)*	**Load Factor**	**Static Test Load** (*Load factor x ADC Weight)*
Sideways	1.5g	(1.5 x 2.8) = 4.2 Lbs	2.0g	(2.0 x 2.8) = 5.6 Lbs
Upwards	3.0g	(3.0 x 2.8) = 8.4 Lbs	1.5g	(1.5 x 2.8) = 4.2 Lbs
Forwards	9.0g	(9.0 x 2.8) = 25.2 Lbs	5.25g	(5.25 x 2.8) = 14.7 Lbs
Downwards	6.6g	(6.6 x 2.8) = 18.5 Lbs	4.0g	(4.0 x 2.8) = 11.2 Lbs

The installer will make a simple test jig that will be used to measure the static test loads as shown in the table above. Perform the tests at the center of gravity of the ADC installation and note results in Ground Functional Test (Chapter 6, section 3.0). An acceptable installation will show no signs of permanent deformation after 3 seconds of applied pressure in all directions of pull.

Document the location of the ADC in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

NOTE: *Ensure that the ADC is not the lowest point in the pitot and static system, to reduce the chances of collecting moisture or water in it. If the ADC cannot be located above the lowest point in the pitot or static system, then a water trap and drain must be installed at the lowest point. Additional field approval and documentation in the Instruction for Continued Airworthiness must be made to inform maintenance personnel of the location and maintenance requirements of the new drain. STC SA02203AK, STC SR02209AK, or STC SA02220AK do not contain approval for new static drains or water traps.*

ARINC-429 ADC

NOTE: *Installation of an ARINC-429 ADC is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. The ARINC-429 ADC installation must be previously existing or performed under a separate FAA installation approval.*

An air data computer with ARINC-429 output can be used in place of the Shadin ADC-2000 provided that the unit outputs the following labels at either low or high speed:

Label	Format	Range
203 Pressure Altitude	BNR Ft.	-2000 to 80000
206 Computed Airspeed	BNR knots	0 to 1024
211 Total Air Temperature	BNR Deg. C	-512 to 512
212 Altitude Rate	BNR ft./min.	-32768 to 32768

Connect the ARINC-429 transmit from the ADC as defined by the manufacturer's Installation Manual to any of the ARINC-429 receive ports on the IDU. The IDU will automatically detect the ARINC word and speed.

For multiple IDU installations, ensure the IDU interconnect harness includes the ARINC-429 receive port as shown in CFS drawing 150-045250. No additional alteration to the ADC installation is required. In an ARINC-429 ADC installation, the fuel flow function can be retained if a Shadin ADC is also installed. Otherwise, the fuel flow function must be disabled using the aircraft limits.

Task 10. Install ADC Cable Assembly

Fabricate the ADC Cable assembly using the wiring diagram in Chapter 4. If the EFIS system interfaces with a single ADC, route the ADC interface cable from PFD J3 to ADC J1. If the EFIS system interfaces with dual ADCs, construct wire harnesses from the ADC to the Remote Switching unit per Chapter 4. Connect the ADC cable

assembly to J1 of the ADC. Route the wiring to the appropriate location. See wiring diagram in Chapter 4 and drawing 702-045250.

NOTE: *In a dual ADC installation, the Fuel Flow left power output (ADC Pin 26) of each ADC will be used to power all fuel flow transducers as shown in drawing 702-045250.*

Task 11. Connect to Pitot and Static Lines

The pitot and static lines should be cut and a tee installed to tap into these lines. Ensure the new tee in the static system is placed between the alternate static source valve and the static instrumentation. Use appropriate type fittings to match the type installed in the aircraft. Install new pitot and static lines and perform a leak check before returning the aircraft to service as described in Chapter 6. For dual ADC installations, if two pitot and static sources are available, connect each ADC to different pitot and static sources, otherwise use the existing pitot and static system.

Task 12. Mounting the OAT Probe

Refer to the Shadin manual IM1201 supplied in the OAT Probe Assy Kit 681201A-1. Use the supplied stiffener to support the probe.

- The sun shield must be installed for proper operation of the OAT probe.
- For single engine installations, avoid mounting the OAT probe on the belly of the aircraft to avoid erroneous readings due to the presence of hot exhaust gases.

NOTE: *Install OAT probe on a smooth, flat surface. Avoid mounting locations that would subject the probe to ram pressure.*

- For the Shadin OAT sensor, splice the red and white wires to the appropriate wires from the ADC 2000 cable assembly. See wiring diagram in Chapter 4 and drawing 702-045250
- Set the calibration value of the OAT probe per Shadin Install Manual, IM2880-AYS8, Stage 4 Loopback configuration.

Document the location of the OAT Probe in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

WARNING!
The OAT probe circuit is susceptible to RF interference. Do not route OAT probe wires next to coax cables attached to transmission devices (Com, transponders, DME, etc.)

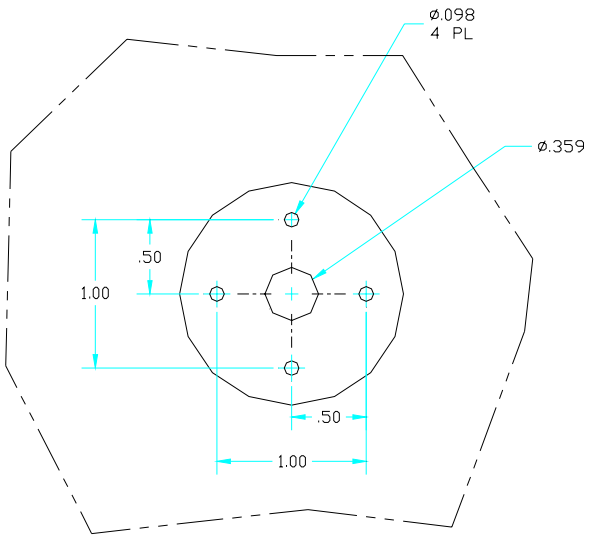


Figure 19: OAT Installation

NOTE: *In a dual ADC installation, each ADC must be connected to a separate OAT probe. OAT probes cannot be connected to more than one ADC.*

Task 13. Install Fuel Flow Transducer

If a fuel flow transducer is not already installed on the aircraft, a new transducer must be installed to use EFIS fuel flow functions.
Use an approved fuel flow transducer and STC from Shadin or J.P. Instruments as applicable for the engine and airframe being modified. See drawing 702-045251 for additional wiring information. The fuel flow transducer should only measure the amount of fuel being consumed by the engine.

NOTE: *If there is no existing fuel flow transducer and no applicable fuel flow transducer STC, the EFIS system fuel flow function must be disabled using the aircraft limits.*

NOTE: *If connecting the fuel flow transducer to more than one air data computer, power is provided by one source at a time. Ensure power is supplied to the transducer at all times. The signal line can be paralleled to multiple air data computers.*

NOTE: *For twin engine installations, verify the ADC is programmed for twin engine operation per Shadin Installation Manual, IM2880-AYS8.*

Task 14. Install GPS Sensor

Install the GPS Sensor in a location as close to the GPS Antenna as is practical. Refer to FreeFlight installation manual 84143-01 (latest revision) and Chapter 4 of this manual for further information on the installation of the GPS receiver.

- Allow approximately 6 inches free space in front of the connectors for the proper bend radius of the coax cable.
- Use an existing shelf or fabricate a new shelf per AC 43.13-2A, Chapter 1, §4 thru §10, and Chapter 2, §24 thru §26 as required using 0.040 inch (min) aluminum for shelf material and brackets. Reinforce shelf as necessary.

Upon determination of a suitable existing shelf, or completion of a new equipment shelf, a static load test must be performed per AC 43.13-2A, Chapter 1, §2 and §3 to determine proper load bearing and security of the equipment. A typical aircraft operating in Normal FAR 23 (CAR 3) category will require a test of the shelf as follows:

Direction of Pull	Fixed Wing		Rotorcraft	
	Load Factor	Static Test Load (*Load factor x GPS Weight*)	Load Factor	Static Test Load (*Load factor x GPS Weight*)
Sideways	1.5g	(1.5 x 0.8) = 1.2 Lbs	2.0g	(2.0 x 0.8) = 1.6 Lbs
Upwards	3.0g	(3.0 x 0.8) = 2.4 Lbs	1.5g	(1.5 x 0.8) = 1.2 Lbs
Forwards	9.0g	(9.0 x 0.8) = 7.2 Lbs	5.25g	(5.25 x 0.8) = 4.2 Lbs
Downwards	6.6g	(6.6 x 0.8) = 5.3 Lbs	4.0g	(4.0 x 0.8) = 3.2 Lbs

The installer will make a simple test jig that will be used to measure the static test loads as shown in the table above. Perform the tests at the center of gravity of the GPS receiver and note results in Ground Functional Test (Chapter 6, Section 3.0). An acceptable installation will show no signs of permanent deformation after 3 seconds of applied pressure in all directions of pull.

- If installing dual GPS receivers, mount the receivers in the same area.

Document the location of the GPS receiver in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

Figure 20: Typical GPS Receiver Installation

Task 15. Install GPS Sensor Cable Assembly

Fabricate the GPS Cable assembly and identify with a label near the connector. The label will state GPS 1 or GPS 2 as required.

- If the EFIS interfaces with a single GPS receiver, locate the GPS interface cable from PFD J1 and terminate at GPS J1 per Chapter 4 or drawing 702-045250.

- If the EFIS interfaces with dual GPS receivers, fabricate cables from each GPS to the Remote Switch unit per Chapter 4 and drawing 702-045250.

Task 16. Install GPS Antenna

The GPS antenna is vertically polarized, optimized for UHF operation, and designed for installation in aircraft, including helicopters. GPS is a line of sight system. This means that the antenna must have an unobstructed view of the satellite. Any "shadowing" or signal shading from the aircraft will degrade the performance of the GPS. Shadowing may be from vertical stabilizers, wings, other antennas, engines, propellers, helicopter rotors, or the fuselage itself.

NOTE: *The minimum separation between the GPS and other antennas is 36 inches. All installations will need to be evaluated for possible interference. Refer to Ground Test (Chapter 5) step 10.3 for interference testing.*

Proper antenna location and installation is very important for the reception of the signals. Install the GPS Antenna on top of the fuselage, parallel to the horizon using figures 21 thru 23 of this chapter.

AC43.13-2A, Chapter 3, §38 describes basic information on mounting rigid antennas. The frontal area of the Aero 81194 GPS antenna is 0.125 sq. ft. Use the equation on page 14 of AC43.13-2A, Chapter 3 to determine the force applied to the skin of the aircraft at V_{ne} and determine if a doubler is required for the antenna site.

- Use RG-142 coax cable or equivalent, 50 foot maximum length.

- To minimize shadowing by other aircraft structure, the GPS Antenna should be located on the top center forward portion of the fuselage. An optional location is on the turtle deck aft of the cockpit.

- Remove paint between antenna and aircraft skin. Alodine per MIL-C-5541.

- Ensure the antenna is electrically bonded to the aircraft surface. A resistance of less than 0.01 ohms is required.

- Doubler is required when aircraft skin is less than 0.040" thick. This doubler should be of the same material as the aircraft skin and be at least 0.040" thick.

- Apply a fillet of sealant around the GPS antenna and the mounting structure after installation for moisture protection.

Document the location of the GPS Antenna in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

Composite Aircraft

Electrical bonding to aircraft ground is extremely important for proper operation of the antenna. The electrical bonding of antennas to composite aircraft is best accomplished by direct metal-to-metal contact of the antenna and/or mounting hardware to an internal ground plane. To do this, mounting hardware must make direct contact to the internal ground plane with the use of a backing plate. The backing plate must make direct contact to the internal ground plane. Sandwich the aircraft skin and internal ground plane between the antenna base plate and internally mounted backing plate. The ground plane should be as large as practical, but should be at least 24" x 24".

NOTE: *Refer to the airframe Maintenance Manual for required torque specifications of mounting hardware on any type of composite skin.*

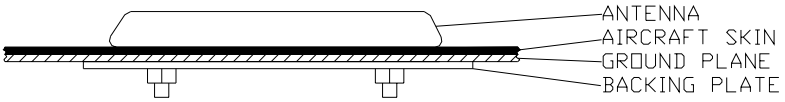


Figure 21: Typical GPS Antenna Installation on Composite Skin

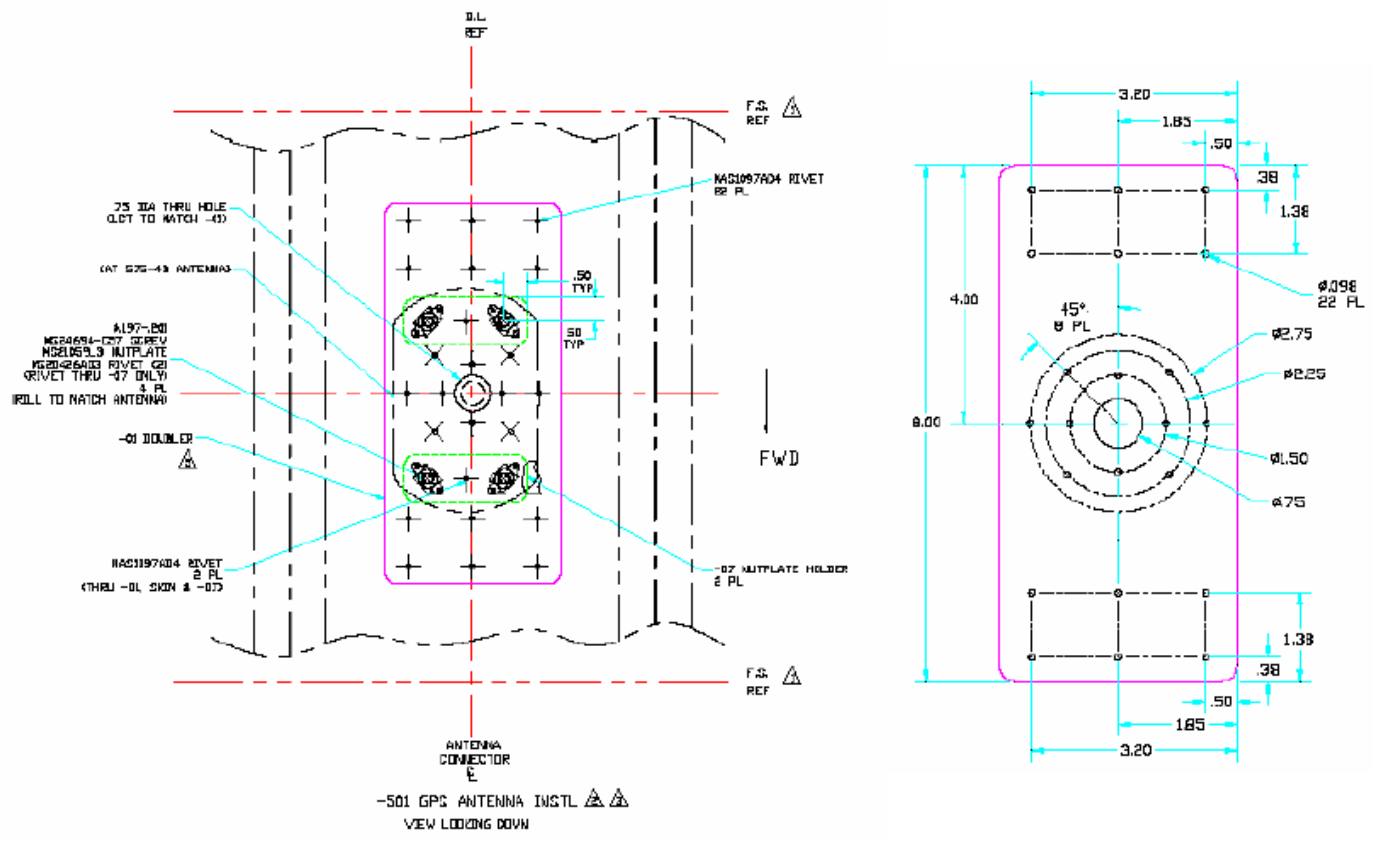


Figure 22: GPS Antenna Installation Aero 81194

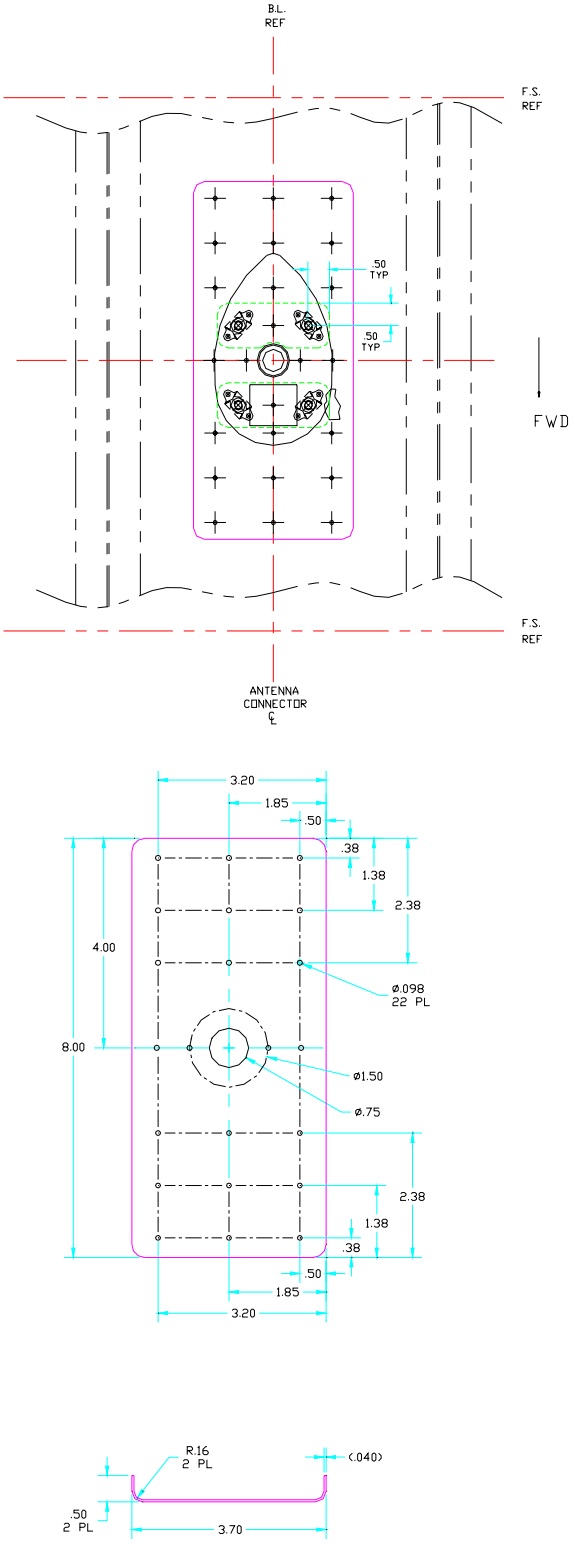


Figure 23: GPS Antenna Installation Comant CI 405-100

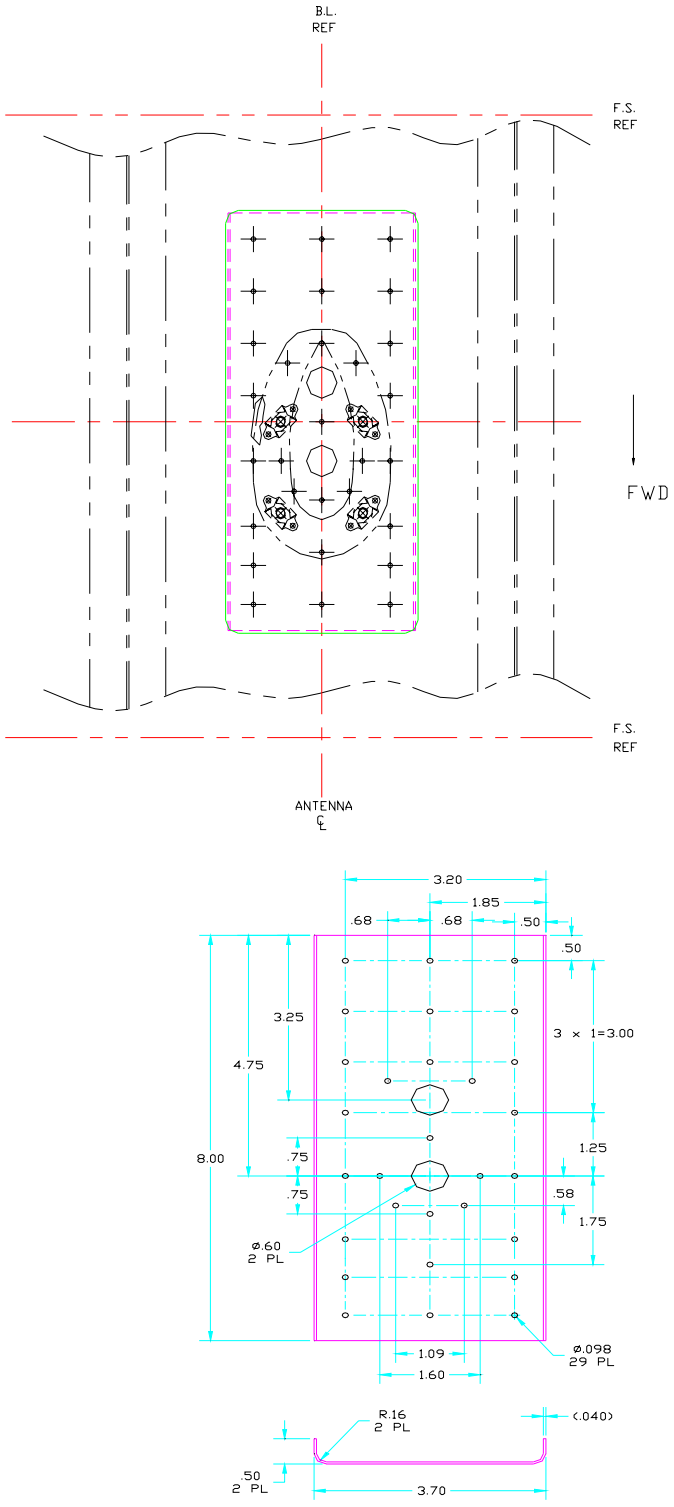


Figure 24: Combine GPS-Com Antenna Installation Comant CI 2480-204

Task 17. AHRS Installation

Crossbow AHRS-500

WARNING!
In order for the AHRS to function properly in a tubular steel fuselage aircraft, you must completely degauss the airframe prior to AHRS installation.

WARNING!
It may be necessary to degauss flight control cables near the AHRS location to prevent magnetic interference.

WARNING!
The AHRS is a highly sophisticated and delicate electronic instrument. Use extreme caution when handling it during installation. Because of the magnetic sensitivity of the AHRS instrument, it is mandatory for the AHRS to be temporarily mounted in the proposed location first. Do not mount it permanently until after successfully testing the entire system for magnetic interference with other equipment.

Selecting the location for the AHRS is a two-step process.

- The first step is to find a "desired" or "proposed" location based on a set of mounting criteria. (See AHRS mounting checklist.)

- The second step is to finalize the mounting location after all other equipment are installed and operational, and you have verified that no magnetic or vibration effects are present.

Most aircraft can accommodate the AHRS behind the aft cabin bulkhead. Whether you want to place the AHRS there, or elsewhere, the location for the AHRS must comply with the following environmental specifications.

AHRS MOUNTING CRITERIA CHECKLIST

Refer to Crossbow AHRS500GA Operators Manual for specific information on mounting and operation of the AHRS. If you have any doubt concerning the AHRS location suitability, please contact your Chelton Flight System technical representative (by phone at (208) 389-9959, or visit our website at www.cheltonflightsystems.com).

☐ **Location and proximity to IDU.**
AHRS can be mounted inside or outside of the pressure vessel. Use GyroView software to determine best location of AHRS by selecting the Navigation Window and viewing the heading deviations as systems around the AHRS are activated, deactivated, and operated throughout their functions. A good location will not display more than a 4° heading change when all systems are operated. Systems can include operation of flaps, landing gears, and engines.

Dual installations must be mounted in the same area.

NOTE: *Do not secure or permanently place the cable until you have completed all the steps below.*

☐ **Distance from metallic objects**
The AHRS must not be located within 24 inches of any large, moving, ferric metal objects such as landing gear components, motors, steel control cables or linkage. Avoid any metallic objects that may change position between ground operations and flight operations, such as landing gear, flap actuators, and control linkages. Static ferric objects, however, can be compensated with internal bias offsets. An ordinary hand compass can be used as a tool to find a magnetically quiet environment. See Crossbow Installation Manual P/N 7410-0001-02 for testing and alignment procedures.

☐ **Distance from wires**
Wires caring high currents, alternate currents, or intermittent currents can cause magnetic variations that will effect the AHRS. Keep wires with these characteristics at least 24 inches away from the AHRS. These wires can include:

- Battery wires
- Strobe wires
- Autopilot control wires
- Position light wires
- De-ice boot wires
- Air conditioning power wires

- HF control wires

❑ **Orientation**

- The unit must be level on the yaw and roll planes of rotation when the aircraft is in a straight and level flight attitude.

WARNING! The AHRS must be aligned with the center line of the aircraft. Failure to align the AHRS to the aircraft center line will cause errors in heading that cannot be corrected.

- The ideal location of the AHRS is as close to the pitch and roll axes as possible. When faced with a decision between the two, it is better for the AHRS to be near or on the roll axis.

- The pitch axis must be level to the aircraft when aircraft is leveled for weight and balance measurements.

- AHRS connector is to face aft of the aircraft.

❑ **Mounting structure**

Use an existing shelf or fabricate a new shelf per AC 43.13-2A, Chapter 1, §4 thru §10, and Chapter 2, §24 thru §26 as required using 0.040 inch (min) aluminum for shelf material and brackets. Reinforce shelf as necessary.

Upon determination of a suitable existing shelf, or completion of a new equipment shelf, a static load test must be performed per AC 43.13-2A, Chapter 1, §2 and §3 to determine proper load bearing and security of the equipment. A typical aircraft operating in Normal FAR 23 (CAR 3) category will require a test of the shelf as follows:

Direction of Pull	Fixed Wing		Rotorcraft	
	Load Factor	**Static Test Load** (*Load factor x AHRS Weight*)	**Load Factor**	**Static Test Load** (*Load factor x AHRS Weight*)
Sideways	1.5g	(1.5 x 4.6) = 6.9 Lbs	2.0g	(2.0 x 4.6) = 9.2 Lbs
Upwards	3.0g	(3.0 x 4.6) = 13.8 Lbs	1.5g	(1.5 x 4.6) = 6.9 Lbs
Forwards	9.0g	(9.0 x 4.6) = 43.2 Lbs	5.25g	(5.25 x 4.6) = 24.2 Lbs
Downwards	6.6g	(6.6 x 4.6) = 30.4 Lbs	4.0g	(4.0 x 4.6) = 18.4 Lbs

The installer will make a simple test jig that will be used to measure the static test loads as shown in the table above. Perform the tests at the center of gravity of the AHRS and note results in Ground Functional Test (Chapter 6, Section 3.0). An acceptable installation

will show no signs of permanent deformation after 3 seconds of applied pressure in all directions of pull.

Document the location of the AHRS in the appropriate Instructions for Continued Airworthiness for the aircraft STC.

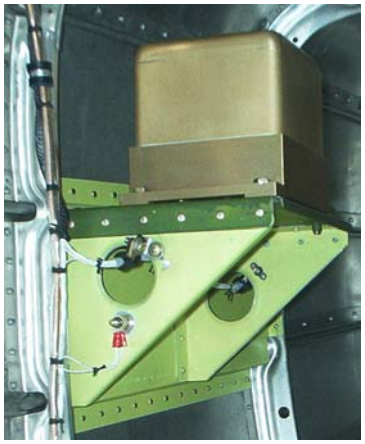


Figure 25: Typical AHRS Installation

WARNING!
Use non-ferrous hardware when mounting the AHRS. Screws, washers, nuts, and nut plates should be made out of stainless steel or brass to prevent heading errors in the AHRS.

FINALIZE THE AHRS INSTALLATION

WARNING!
The AHRS is a highly sophisticated and delicate electronic instrument. Use extreme caution when handling it during installation. Test the AHRS with all equipment/accessories on and the engine running prior to final installation.

Task 17-1. Secure the AHRS Wiring

The AHRS must be mounted clear of any wiring bundles, strobe lines, antennas, or anything that may cause magnetic or electrical interference. Secure the wiring allowing access and movement of the AHRS unit.

Task 17-2. Degauss Control Cables and Hardware

Degauss all control cables, attachment hardware, and other equipment located within a 24 inch area of the AHRS unit using a hand-held degausser. Most audio and video degaussing units can be used.

Move all control cables to their full extents and operate all equipment to ensure that there are no adverse affects to the AHRS heading. An adverse affect would be a heading change of more than 4° at any time.

Task 17-3. Permanently Mount the AHRS

Secure the AHRS Unit to the mounting structure being careful to install all of the shims that were required to level on the yaw and roll planes of rotation when the aircraft is in a straight and level flight attitude.

Final AHRS Configuration Note

After the entire EFIS is installed and wired, certain components require specific configuration in order as follows:

1. After installation is complete and while flight testing the aircraft, note the displayed attitude from the PFD while in level flight. If the horizon line is shown too high, the AHRS must be tilted "nose up" a corresponding amount to bring the horizon line to the center of the screen.

NOTE: *Typically, the waterline symbol should be 0° to 2º- 3º above the horizon line in straight and level flight.*

2. Carefully shim the AHRS with aluminum washers as needed.

3. Likewise, if the PFD page shows a slight bank when the aircraft is in level flight, shimming may be required. Typically, the horizon line of the PFD should be near the center of the display when the aircraft is loaded with its typical payload. Once set, a discernible difference in aircraft attitude will be noticed throughout the range of airspeed, weight, and angle of attack combinations.

Litef LCR-93 AHRS

The Litef LCR-93 AHRS option is described in Appendix D of this manual.

ARINC-429 AHRS

NOTE: *Installation of an ARINC-429 AHRS is not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. The ARINC-429 AHRS installation must be previously existing or performed under a separate FAA installation approval.*

An AHRS with ARINC-429 capabilities can be used in place of the Crossbow 500 provided it outputs the following labels at either low or high speed:

Label	Format	Range
320 Magnetic Heading	BNR Degrees	+/-180
324 Pitch Angle	BNR Degrees	+/-90
325 Roll Angle	BNR Degrees	+/-180
331 X-axis Acceleration	BNR G	+/-4
333 Z-axis Acceleration	BNR G	+/-4

Connect the ARINC-429 transmit from the AHRS as defined by the manufacturer's Installation Manual to any unused ARINC-429 receive ports on the IDU. The IDU will automatically detect the ARINC words and speed.

For multiple IDU installations, ensure the IDU interconnect harness includes the ARINC-429 receive port as shown in CFS drawing 150-045250. No additional alteration to the AHRS installation is required.

Task 18. Voice Warning System (VWS)

The VWS is connected to any unswitched, non-amplified mono audio input or an auxiliary input of an audio panel or intercom system. The VWS must be available to the pilot at all times and may not be muted when a Com radio or the intercom is active.

Audio panels and intercom systems equipped with a Pilot Isolate function will allow operation of the VWS without broadcasting to the other passengers through their headphones or cabin speaker.

The installer is required to furnish a SPST, normally open, momentary push-button switch for audio mute. The mute switch stops the VWS from continually reporting a warning condition until a new warning condition is displayed.

VWS INSTALLATION CHECKLIST

- ❑ **Install the VWS wiring as directed by the audio panel or intercom manufacturer's documentation to the un-muted audio input.**
- ❑ **Run a separate wire for the remote-mounted mute switch. This switch is a "momentary on" switch (push-to-talk or PTT) and generally located on the control column or other convenient location, as it must be accessible by the pilot during all phases of flight. The switch is labeled "EFIS MUTE".**
- ❑ **Wire and install the mute switch according to the wiring diagram.**
- ❑ **Secure wires to the airframe as necessary.**
- ❑ **Ensure that all connectors and plugs are assembled, connected, and secure.**
- ❑ **Adjust the audio volume for a comfortable level as described in Chapter 5 of this manual.**

Task 19. EFIS Switches and Annunciations

The EFIS installation kit contains SPDT toggle switch for TAWS INHIBIT with placard. Additional SPDT toggle switches are included for dual ADC, AHRS, and GPS sensors with placards. The installer has the option of using Eaton or Korry annunciators and annunciated switches.

NOTE: *Refer to Field Service Notice: EFIS-II Installation Doc. 150-045947 for manufacturers and part numbers of annunciators/switches and associated hardware.*

Wire all required switches, annunciators, terminal blocks, and diode modules per drawing 702-045250 and 702-045251 for the equipment being installed.

The optional EFIS annunciators and annunciated switches can be wired into the existing aircraft annunciator dimming circuit if applicable. The dimming requirements are as follows:

Bus Voltage	Bright Voltage	Dim Voltage
28VDC	28VDC	11VDC
14VDC	14VDC	5.1VDC

If no existing dimming circuit is available, use drawing 702-045251 for the dimming circuit.

Task 20. IDU Backlighting

Normal operation of the display backlighting adjustment is performed by rotating the left-hand encoder clockwise for increase intensity and counter-clockwise for decrease intensity. Button and knob backlight adjustment is performed by pressing in the left-hand encoder and rotating CW for brighter and CCW for dimmer.

Each IDU will determine the proper level of display and button backlighting by a photo sensor located on the upper left-hand corner of the unit. This photo sensor measures the ambient light on initial power up and adjusts the display and button backlighting. The photo sensor is not used after initial display adjustment.

The EFIS IDUs can be connected to an EFIS master dimmer source that would be located on the instrument panel. This EFIS dimmer would provide a control voltage to the IDUs on P3 and P4 that would increase and decrease all IDUs simultaneously. Wiring of this optional circuit is shown in drawing 702-045251.

Adjustment of individual IDUs will still be allowed through the rotation of the left hand encoder. The photo sensor of the IDUs will not be used to determine initial intensity settings with this option.

Task 21. Landing Gear

Landing gear input is required for Class-"A" TAWS, but can be displayed on the PFD under the Flight Path Marker for any configuration. The IDU requires a ground input as a "Down and Lock" condition. For those aircraft that produce a signal other than ground, refer to drawing 702-045251 for reverse logic wiring.

NOTE: *The EFIS requires all landing gear inputs used for landing gear indications. If the aircraft provides only one switch for indication, all three inputs must be wired to the same point to prevent unwanted landing gear warnings.*

Task 22. IDU Installation

The slip or non-slip housing will be installed on the IDU prior to mounting in the rack. The installer will determine which housing is to be installed on the IDU. The slip housing will be installed on the IDU that is directly in front of the pilot. Optional slip housing can be installed on the IDU that is directly in front of the co-pilot if desired. The slip and non-slip housings are installed with two 4-40x 0.125" countersink screws (supplied with housing) on the bottom of the bezel. Use Loctite® 222 to secure screws as required.

Install the IDU in the rack until it stops. Insert a 3/32" hex driver in the lower left-hand hole on the bezel and rotate clockwise until the IDU is fully seated and the screw has stopped turning. The IDU will be flush with the instrument panel.

NOTE: *To reduce the chances of cross-threading the IDU locking screw in the tray, rotate the screw counter-clockwise until you feel the screw bottom on the threads, then rotate clockwise to tighten.*

WARNING!
Gently push the IDU into the tray as the IDU mounting screw is tightened to reduce the chance of jamming the screw in the tray.

Removal of the IDU is performed by inserting a 3/32" hex driver in the lower left-hand hole on the bezel and rotate counter-clockwise until the IDU stops moving away from the instrument panel. Take the IDU by its sides and slide the unit completely out of the tray.

WEIGHT AND BALANCE

The removal and addition of equipment results in changes to the aircraft center of gravity. After all of the equipment and wiring is completely installed and secured, a weight and balance procedure shall be performed in accordance with AC 43.13-1B, Chapter 10 and/or FAA-H-8083-1.

NOTE TO RESELLERS: *Keep track of this location as reference for future installations in identical aircraft models. Keep in mind, however, that because of differences in construction, electrical equipment, placement of electrical wiring, and other variables, this location may not work in another seemingly identical aircraft. Complete the installation test described above for each and every AHRS installation.*

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Chapter 3

EFIS Pin Assignment

IDU

The EFIS system is designed to parallel all external sensor inputs to each IDU for redundancy. This paralleling is accomplished by a circuit board located on the back of each IDU tray assembly to ease the installation process.

The circuit board provides lightning protection for the IDU and wire routing between the ARINC-600, 150 pin connector (J1) and the 37 pin circular (P2), two 66 pin circular primary interface (P3 and P4), two 55 pin circular secondary interface (P5 and P6), and SCC (P7) connectors.

The two primary interface connectors, P3 and P4, are identical in their size, pin assignment, and function. Likewise, the two secondary interface connectors, P5 and P6, are identical. This allows the installer to mate to either connector on any tray.

A standard installation would have the 66 pin connector that interfaces with the external sensors mated to a tray assembly with two 66 pin plugs, and interconnect harness(es) installed in a “daisy chain” manner to complete the wiring. It is not required to start the “daisy chain” at the PFD or the last MFD, but can be connected to the most convenient tray. The same process is used for the 55 pin connector.

J1 IDU Interface

The J1 connector is an ARINC-600 series, 150 pin connector mounted inside of the tray. This connector is the main interface between the IDU and the rest of the system. The connector is shown as follows viewed from the front of the tray:

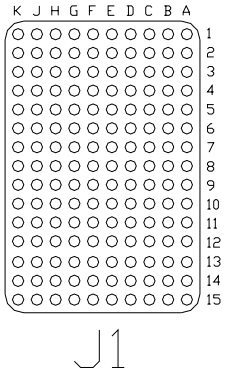

Figure 25: Tray Interface Connector J1 (Viewed from front)

Pin designations are described in the following section.

P2 Power and Transmit Connector

The P2 connector is used to supply power and ground for IDU and contains the four ARINC-429 transmitter ports. The P2 connector does not get paralleled to any other IDU P2 connector.

The resistance values in the following tables are measured from J1 to P2 with a digital multi-meter in ohms.

Power and Ground

The IDU operates between 9 and 34VDC using pins:

Label	J1	P2	Resistance
POWER	D14	5	0
POWER	D15	6	0
POWER	E14	7	0
POWER	E15	8	0
GROUND	D09	24	0
GROUND	D10	25	0
GROUND	D11	26	0
GROUND	D12	31	0

Remote Select

The REMOTE SELECT line performs the same function as pressing the right-hand encoder in when grounded. The REMOTE SELECT

will produce one “ENTER” command per ground pulse, and will be ignored if the ground is constant.

Label	J1	P2	Resistance
REMOTE SELECT	C14	4	300

CRT Output

The CRT outputs are used for manufacturing test and are not used at this time.

Label	J1	P2	Resistance
CRT VERTICAL SYNC	F13	9	300
CRT BLUE	F14	10	75
CRT GREEN	F15	11	75
CRT RED	G14	12	75
CRT HORIZONTAL SYNC	G15	13	300

ARINC-429 Transmit

The two ARINC-429 transmit ports (COM21 and COM22) broadcast the same labels. COM21 transmits at low speed and COM22 transmits at high speed. COM23 and Com24 are used to emulate a Bendix/King EFIS-40/50 Symbol Generator for interfacing to existing KFC-325 and KFC-225 installations. COM23 transmits at low speed and Com24 transmits at high speed.

Label	J1	P2	Resistance
COM 21 TXA (+) (LOW)	A11	14	28
COM 21 TXB (-) (LOW)	B11	27	28
COM 22 TXA (+) (HIGH)	A12	15	28
COM 22 TXB (-) (HIGH)	B12	28	28
COM 23 TXA (+) (EFIS)	A13	16	28
COM 23 TXB (-) (EFIS)	B13	29	28
COM 24 TXA (+) (EFIS)	A14	17	28
COM 24 TXB (-) (EFIS)	B14	30	28

The ARINC labels transmitted on Com21 and Com22 are as follows:

Label (ARINC-429 Names)	Format & Units	Range	Sig. bits
100 Selected Course	BNR Degrees Magnetic	+/-180	12
101 Selected Heading	BNR Degrees Magnetic	+/-180	12
114 Desired Track	BNR Degrees True	+-180	12
115 Waypoint Bearing	BNR Degrees Magnetic	+/-180	12
116G Cross Track Distance	BNR NM	128	18
121 Horizontal Command Signal	BNR Degrees	+/-180	14
122 Vertical Command Signal	BNR	+/-180	12
125 Greenwich Mean Time	BCD	Hr/Min.	5
164 AGL Altitude	BNR Feet	8192	12
203 Pressure Altitude	BNR Feet	131072	17
204 Baro Corrected Altitude	BNR Feet	131072	17
206 Computed Airspeed	BNR Knots	1024	14
210 True Airspeed	BNR Knots	2048	15
211 Total Air Temperature	BNR Deg. C	512	11
212 Altitude Rate	Feet/Min.	32768	11
213 Static Air Temperature	BNR Deg. C	512	11
235 Altimeter Setting	BCD in. Hg.	2200 to 3200	5
251 Distance to Go	BNR NM	4096	15
310 Present Position –Latitude	BNR Degrees	+/-180	20
311 Present Position –Longitude	BNR Degrees	+/-180	20
312 Ground Speed	Knots	4096	15
313 Track Angle	BNR Degrees True	+/-180	15
314 True Heading	BNR Degrees True	+/-180	15
320 Magnetic Heading	BNR Degrees Magnetic	+/-180	15
324 Pitch Angle	BNR Degrees	+-180	14
325 Roll Angle	BNR Degrees	+-180	14
326G Lateral Scale Factor	BNR NM	128	15

The ARINC labels transmitted on Com23 and Com24 are as follows:

Label (ARINC-429 Names)	Format & Units	Range	Sig. bits
121 Horizontal Command Signal	BNR Degrees	+/-180	14
164 AGL Altitude	BNR Feet	8192	12
173 Localizer Deviation Valid	N/A	N/A	N/A
174 Glideslope Deviation Valid	N/A	N/A	N/A
202G DME Distance	BNR NM	512	16
300 EFIS Mode Status	N/A	N/A	N/A
301 Localizer Back Course Valid	N/A	N/A	N/A
377 Equipment ID	N/A	N/A	N/A

Emergency Battery Output (PFD) / EFIS Valid (MFD)

This pin is used for two different functions depending on the operation of the IDU. In a multiple display system, the IDU operating as PFD (SCC #1) will pull this pin to ground when in Flight mode (greater than 40Kts of airspeed), and open when in Ground mode (less than 40Kts of airspeed). This pin can be connected to an emergency battery or other backup power source to keep a standby source of power available for EFIS operations while in flight.

When the IDU is operating as a MFD (SCC #0, 2, 3, or 4), this pin operates as the EFIS Valid for autopilot operations. The IDU monitors the validity of the AHRS and the AIU (if installed), and will set the pin invalid if one of the sensors has failed. The valid state is programmed by setting the EFIS Valid Polarity either as active high or active low on the IDU Limits program. See Chapter 5 for details of this setting.

This output can sink 100mA to drive an external relay or interface to an autopilot input. For autopilots that do not have an EFIS Valid input, this pin can be wired in parallel to the Autopilot Disconnect switch. In this application, the autopilot will automatically disconnect when the EFIS senses an error in one of the sensors.

Label	J1	P2	Resistance
UPS OUT / EFIS VALID	H14	18	56

Additional Grounds

The remainder of the P2 connector is additional GROUND pins that may be used. These pins are on the same ground plane as the power grounds described above.

Label	J1	P2	Resistance
GROUND	D04	19	0
GROUND	D05	20	0
GROUND	D06	21	0
GROUND	D07	22	0
GROUND	D08	23	0
GROUND	E03	32	0
GROUND	E04	33	0
GROUND	E05	34	0
GROUND	E06	35	0
GROUND	E07	36	0
GROUND	E08	37	0

Not Connected Pins

The following pins on P2 are not connected:

Label	J1	P2	Resistance
NOT CONNECTED		1	
NOT CONNECTED		2	
NOT CONNECTED		3	

P3/P4 Primary Interface Connector

Resistance is measured between J1 and P3 or P4 with a digital multi-meter in ohms.

Keyboard

The KEYBOARD lines are connected in parallel to all IDUs in the EFIS system. The IDU with a SmartMedia card installed on power up will have command over the keyboard and accept information from the keyboard. All other IDUs will not be functional with the keyboard, but must have power applied to allow the keyboard to operate. The keyboard connector is as follows:

Label	J1	P3/4	Resistance
KEYBOARD POWER	G13	1	0
KEYBOARD DATA	E13	2	100
KEYBOARD CLOCK	D13	6	100
KEYBOARD GROUND	E07	14	0

External Backlighting Option

When connected, the photo sensor on each IDU is ignored and display intensity is controlled by the BACKLIGHT CONTROL line. The left hand encoder can still be used to adjust one display higher or lower than another as required.

The BACKLIGHT REFERENCE VOLTAGE input is connected to the maximum dimming voltage (5-30VDC). This voltage can be supplied by the aircraft avionics bus or other voltage source as required.

The BACKLIGHT CONTROL input is connected to an adjustable voltage with a range of 0VDC to BACKLIGHT REFERENCE VOLTAGE. The ratio between the BACKLIGHT REFERENCE VOLTAGE and BACKLIGHT CONTROL inputs minus the left hand encoder setting will determine the proper level of the backlighting.

Label	J1	P3/4	Resistance
BACKLIGHT REF	C15	4	1000
BACKLIGHT CONTROL	B15	11	1000

Audio

The IDU AUDIO is designed to connect directly to the unmuted audio input of an existing aircraft audio system. The output is 125mW maximum at 600 ohms impedance. The PFD is default for audio output. If the PFD were to fail, then the No1 MFD would output audio, and so on.

Label	J1	P3/4	Resistance
AUDIO OUT	A15	5	100
AUDIO GROUND	E06	13	0

Mute

The MUTE input detects a momentary ground by a push button switch to stop the aural annunciation when a warning condition is activated. If a new warning condition occurs after the mute switch is pressed, the

new warning will repeat until the mute switch is again pressed or the condition has been corrected.

Label	J1	P3/4	Resistance
MUTE	C13	10	300

+5VDC Output

An extra +5VDC output is available at the connector. This output can be used for backlight reference or pull up excitation for external devices.

Label	J1	P3/4	Resistance
+5VDC OUTPUT	H13	12	0

Low Altitude

Grounding the LOW ALTITUDE line inhibits the HTAWS alerting for helicopter operations. This input is held low to inhibit HTAWS and opened to allow HTAWS.

Label	J1	P3/4	Resistance
LOW ALTITUDE	C07	3	300

TAWS Inhibit

Grounding the TAWS INHIBIT line inhibits the TAWS alerting for fixed wing aircraft operations. This input is held low to inhibit TAWS and opened to allow TAWS.

Label	J1	P3/4	Resistance
TAWS INHIBIT	C06	8	300

Landing Gear

The GEAR inputs are grounded to signify “down and locked” landing gear. The EFIS monitors three landing gear inputs, and will report a “split gear” condition if all three are not grounded or open at the same time. If connecting to an aircraft with a single landing gear position switch, all three inputs must be tied to the same point.

Label	J1	P3/4	Resistance
RIGHT GEAR	C04	9	300
LEFT GEAR	C05	15	300
NOSE GEAR	C03	16	300

Master Caution

The MASTER CAUTION output is grounded when a warning condition is sensed by the EFIS. The ground is continuous until the condition is removed. This output can sink 100mA at 5VDC to drive an external annunciator with current limiting. The PFD is default for MASTER CAUTION control. If the PFD were to fail, then the No1 MFD would control this line, and so on.

Label	J1	P3/4	Resistance
MASTER CAUTION	H15	18	56

ARINC-429 Receive Ports

There are two ARINC-429 receiver ports on the P3 and P4 connector. Both ports are enabled to receive the same labels as outlined below at either high or low speed. The speed of the port is auto-detected.

Navigation receivers (VOR/LOC/GS/MB), ADF receivers, Radar Altimeters, ADCs, AHRS, and Flight Director Computers or Autopilots that output data in the ARINC format defined below can be interfaced directly to the IDU(s) as required.

NOTE: *When interfacing the EFIS to a Navigation receiver that contains both ARINC-429 and analog output signals (such as a Garmin GNS-430/530), it is advisable to use the ARINC-429 output data for EFIS processing and display. Ensure the SDI bit of the radio is set properly. See the AIU Installation Manual, Doc. 570-7000 for additional information on Navigation interface requirements.*

Label	J1	P3/4	Resistance
COM21 RXA (+)	A03	32	1000
COM21 RXB (-)	B03	33	1000
COM22 RXA (+)	A04	23	1000
COM22 RXB (-)	B04	24	1000

The labels are defined as follows:

Label (ARINC-429 Names)	Format & Units	Range	Sig. bits
130 Intruder Range			
131 Intruder Altitude			
132 Intruder Bearing			
140 Flight Director Roll	BNR Degrees	+/-180	12
141 Flight Director Pitch	BNR Degrees	+/-180	12
162 ADF Bearing	BNR Degrees	+/- 180	12
164 Radio Height	BNR	8192	16
165 Radio Height	BCD	9999.9	5
173 Localizer Deviation	BNR	4	11
174 Glideslope Deviation	BNR	4	11
203 Pressure Altitude	BNR Ft.	131072	17
206 Computed Airspeed	BNR knots	1024	14
211 Total Air Temperature	BNR Deg. C	512	11
212 Altitude Rate	BNR ft./min.	32768	11
222 VOR Bearing	BNR Degrees	+/-180	12
320 Magnetic Heading	BNR Degrees	+/-180	15
324 Pitch Angle	BNR Degrees	+/-180	14
325 Roll Angle	BNR Degrees	+/-180	14
331 X-axis Acceleration	BNR G	+/-4	12
332 Y-axis Acceleration	BNR G	+/-4	12
333 Z-axis Acceleration	BNR G	+/-4	12
350 Maintenance Data			
357 TCAS Data File			
371 GA Equip. Code	BCD & Disc.		
377 Equip. Code	BCD & Disc.		

RS-422 Ports

There is one RS-422 transmit and receive port on the P3 and P4 connector. The PFD is the default device to transmit data on this port. If the PFD were to fail, then the No1 MFD transmits, and so on.

Com9 transmitter emulates a KLN-90B for interface with external devices that need GPS data or remote tuning as follows:

Engine monitoring devices such as the Shadin ETM
MFDs such as the Garmin MX-20, Bendix/King KMD-550, or Avidyne FlightMax
Nav/Com transceivers such as the Bendix/King KX155A/165A or Apollo SL-30

When using this option, connect the TXB output of the IDU to the RX input of the external device and leave the TXA output open.

Label	J1	P3/4	Resistance
COM09 TXA (+)	G04	41	100
COM09 TXB (-) (GPS)	G03	42	100
COM09 RXA (+)	H02	49	1000
COM09 RXB (-)	H01	50	1000

RS-232 Ports

The RS-232 ports for P3 and P4 are programmed for specific interfacing at defined baud rates. The PFD is the default device to transmit data on any of these ports. If the PFD were to fail, then the No1 MFD transmits, and so on. These ports are as follows:

Label	J1	P3/4	Resistance
COM01 TX (GPS)	J01	57	100
COM01 RX (GPS)	K01	56	1000
COM01 GND (GPS)	H08	40	0
COM02 TX (AHRS)	J02	63	100
COM02 RX (AHRS)	K02	62	1000
COM02 GND (AHRS)	H12	48	0
COM03 TX (DL)	J03	66	100
COM03 RX (DL)	K03	61	1000
COM03 GND (DL)	J11	55	0
COM04 TX (WX)	J04	65	100
COM04 RX (WX)	K04	60	1000
COM04 GND (WX)	H11	47	0
COM05 TX (TCAD)	J05	64	100

Label	J1	P3/4	Resistance
COM05 RX (TCAD)	K05	59	1000
COM05 GND (TCAD)	J10	54	0
COM06 TX (AIU)	J06	52	100
COM06 RX (AIU)	K06	58	1000
COM06 GND (AIU)	J09	53	0
COM13 RX (ADC)	K09	44	1000
COM13 GND (ADC)	H06	38	0
COM14 RX	K10	51	1000
COM14 GND	H10	46	0
COM15 RX	K11	43	1000
COM15 GND	H09	45	0
COM16 RX	K12	35	1000
COM16 GND	H05	37	0

IDU Interface

There are four RS-232 receiver lines that are connected to all IDUs in the EFIS system. These receive lines must be connected if more than one IDU is present. The information on these lines contain flight plan, IDU mode, and IDU health status.

A standard two screen installation would require the COM17 and COM18 interface lines to be used. A three screen installation would add the COM19, and a four screen installation would add the COM20 interface lines.

Label	J1	P3/4	Resistance
COM17 RX (PFD)	K13	34	1000
COM17 GND (PFD)	F09	36	0
COM18 RX (MFD1)	K14	26	1000
COM18 GND (MFD1)	F05	28	0
COM19 RX (MFD2)	K15	25	1000
COM19 GND (MFD2)	E12	27	0
COM20 RX (MFD3)	J15	17	1000
COM20 GND (MFD3)	E08	19	0

Unassigned Discrete

There is one unassigned discrete input as follows:

Label	J1	P3/4	Resistance
DISCRETE 06	C08	7	300

Additional Grounds

The remainder of the P3/P4 connector is additional GROUND pins that may be used. These pins are on the same ground plane as the power grounds described above.

Label	J1	P3/4	Resistance
GROUND	E09	20	0
GROUND	E10	21	0
GROUND	E11	22	0
GROUND	F06	29	0
GROUND	F07	30	0
GROUND	F08	31	0
GROUND	H07	39	0

P5/6 Secondary Interface Connector

This connector set is optional and is used when additional communication interfacing is required.

ARINC-429 Ports

There are 6 additional ARINC-429 receive ports on this connector. These ports operate the same as COM21 and COM22 of P3/4.

Label	J1	P5/6	Resistance
COM23 RXA (+)	A05	49	1000
COM23 RXB (-)	B05	53	1000
COM24 RXA (+)	A06	50	1000
COM24 RXB (-)	B06	54	1000
COM25 RXA (+)	A07	51	1000
COM25 RXB (-)	B07	55	1000
COM26 RXA (+)	A08	52	1000
COM26 RXB (-)	B08	45	1000
COM27 RXA (+)	A09	39	1000
COM27 RXB (-)	B09	46	1000
COM28 RXA (+)	A10	24	1000
COM28 RXB (-)	B10	31	1000

RS-422 Ports

There are three additional RS-422 ports that are undefined at this time. The PFD is the default device to transmit data on any of these ports. If the PFD were to fail, then the No1 MFD transmits, and so on.

Label	J1	P5/6	Resistance
COM10 TXA (+)	F04	4	100
COM10 TXB (-)	F03	5	100
COM11 TXA (+)	C02	32	100
COM11 TXB (-)	C01	33	100
COM12 TXA (+)	B02	47	100
COM12 TXB (-)	B01	40	100
COM10 RXA (+)	E02	17	1000
COM10 RXB (-)	E01	10	1000
COM11 RXA (+)	D02	25	1000
COM11 RXB (-)	D01	18	1000
COM12 RXA (+)	A02	48	1000
COM12 RXB (-)	A01	41	1000

RS-232 Ports

The PFD is the default device to transmit data on any of these ports. If the PFD were to fail, then the No1 MFD transmits, and so on. There are two additional RS-232 ports that are defined as follows:

Label	J1	P5/6	Resistance
COM07 TX (ADS-B)	J07	6	100
COM07 RX (ADS-B)	K07	1	1000
COM07 GND (ADS-B)	H03	12	0
COM08 TX	J08	2	100
COM08 RX	K08	7	1000
COM08 GND	D05	13	0

Discretes

There are four discretes that are undefined at this time.

Label	J1	P5/6	Resistance
DISCRETE 07	C09	16	300
DISCRETE 08	C10	9	300
DISCRETE 09	C11	8	300
DISCRETE 10	C12	3	300

Additional Ground

The remainder of the P5/P6 connector is additional GROUND pins that may be used. These pins are on the same ground plane as the power grounds described above.

Label	J1	P5/6	Resistance
GROUND	D06	14	0
GROUND	D07	19	0
GROUND	F08	20	0
GROUND	F09	21	0
GROUND	F10	22	0
GROUND	F11	26	0
GROUND	F12	27	0
GROUND	G05	28	0
GROUND	G06	29	0
GROUND	G07	30	0
GROUND	G08	34	0
GROUND	G09	35	0
GROUND	G10	36	0
GROUND	G11	37	0
GROUND	G12	42	0
GROUND	H03	43	0
GROUND	H04	44	0

Not Connected Pins

The following pins on P5/6 are not connected:

Label	J1	P5/6	Resistance
NOT CONNECTED		11	
NOT CONNECTED		15	
NOT CONNECTED		23	
NOT CONNECTED		38	

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Chapter 4

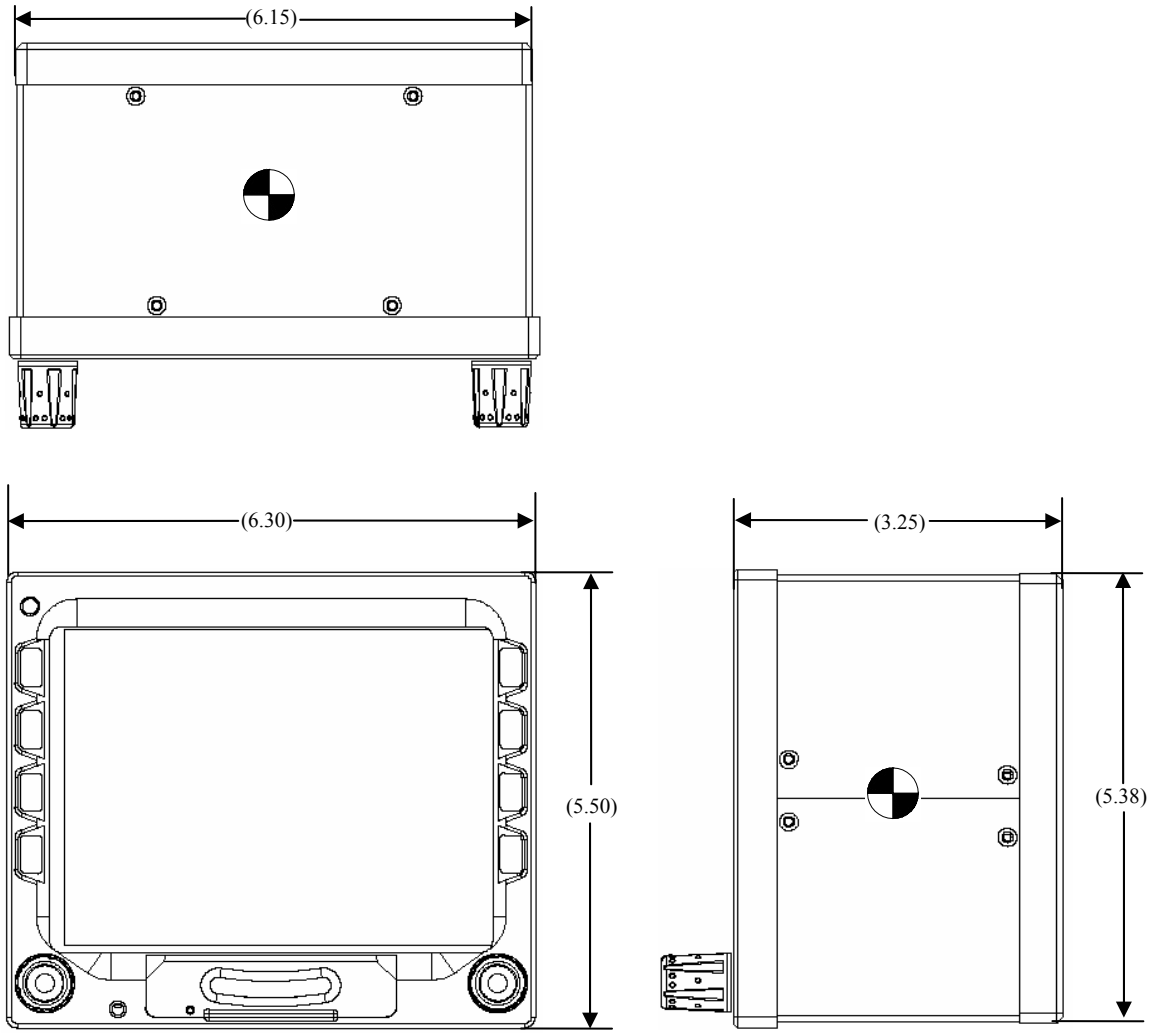
System Drawings

This chapter contains the mechanical and electrical drawings for the EFIS system. Additional drawings can be found in the appropriate vendor Installation Manuals.

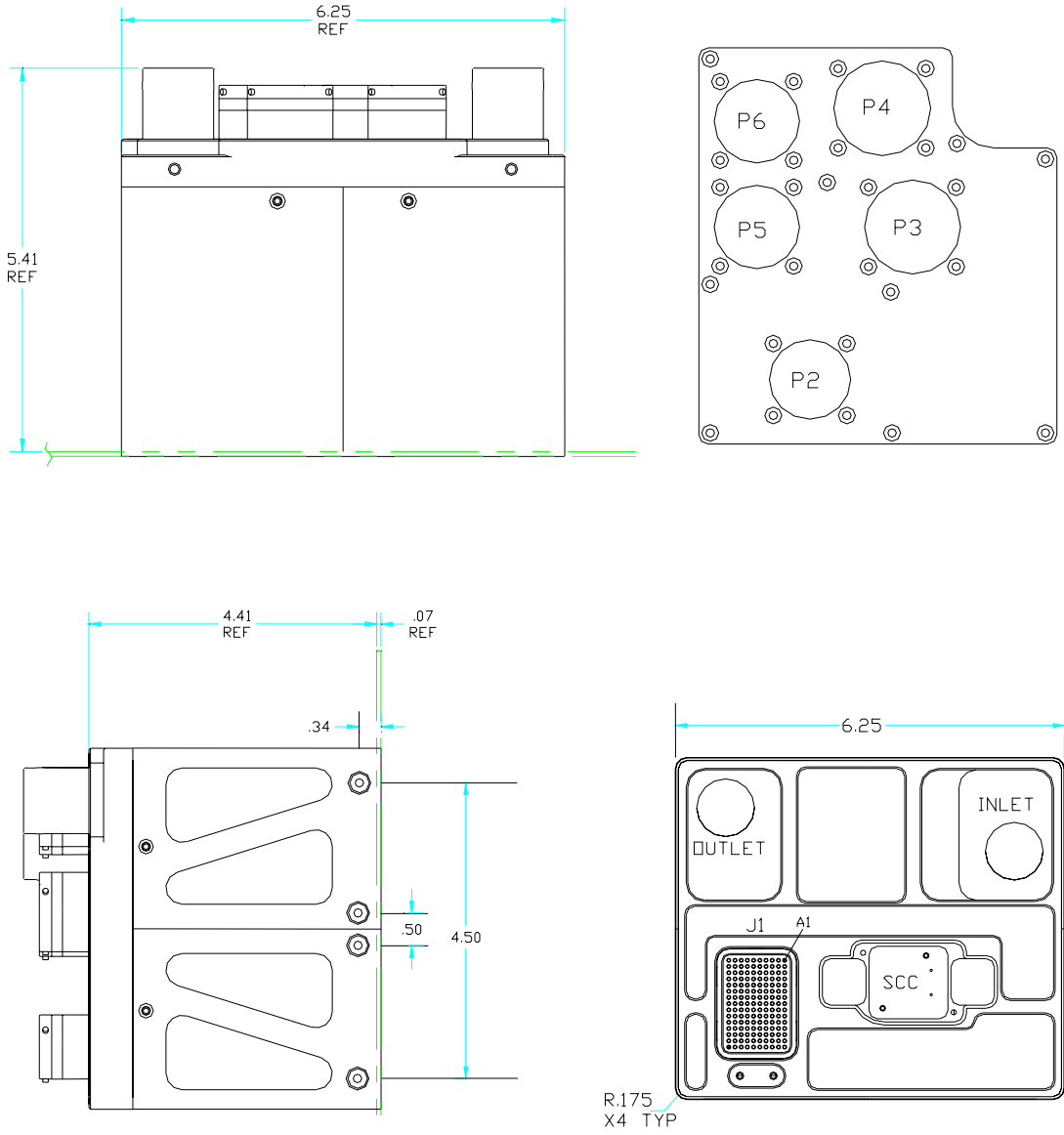
Drawings:

NOTE: The pinouts of all connectors referenced in the documents above are viewed from the wire end of the connector.

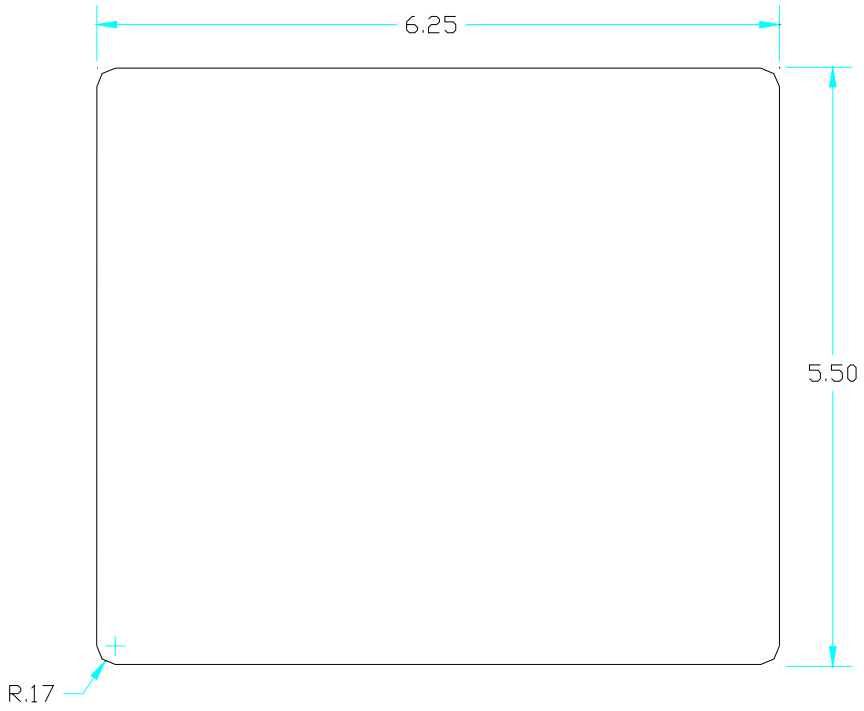
4.1 IDU MECHANICAL DRAWING

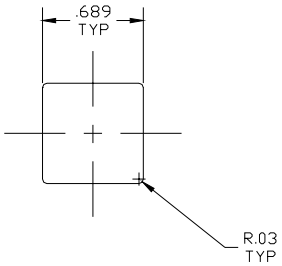


4.2 IDU TRAY MECHANICAL DRAWING

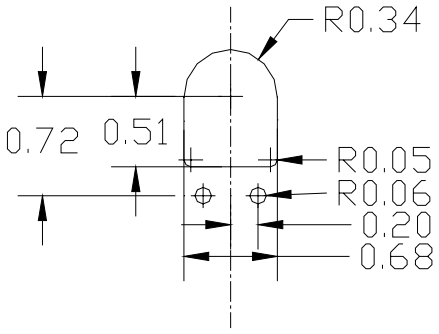


4.3 PANEL CUTOUT DRAWING

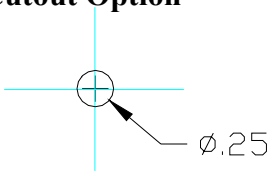




Korry or Eaton Annunciated Switch Cutout Option

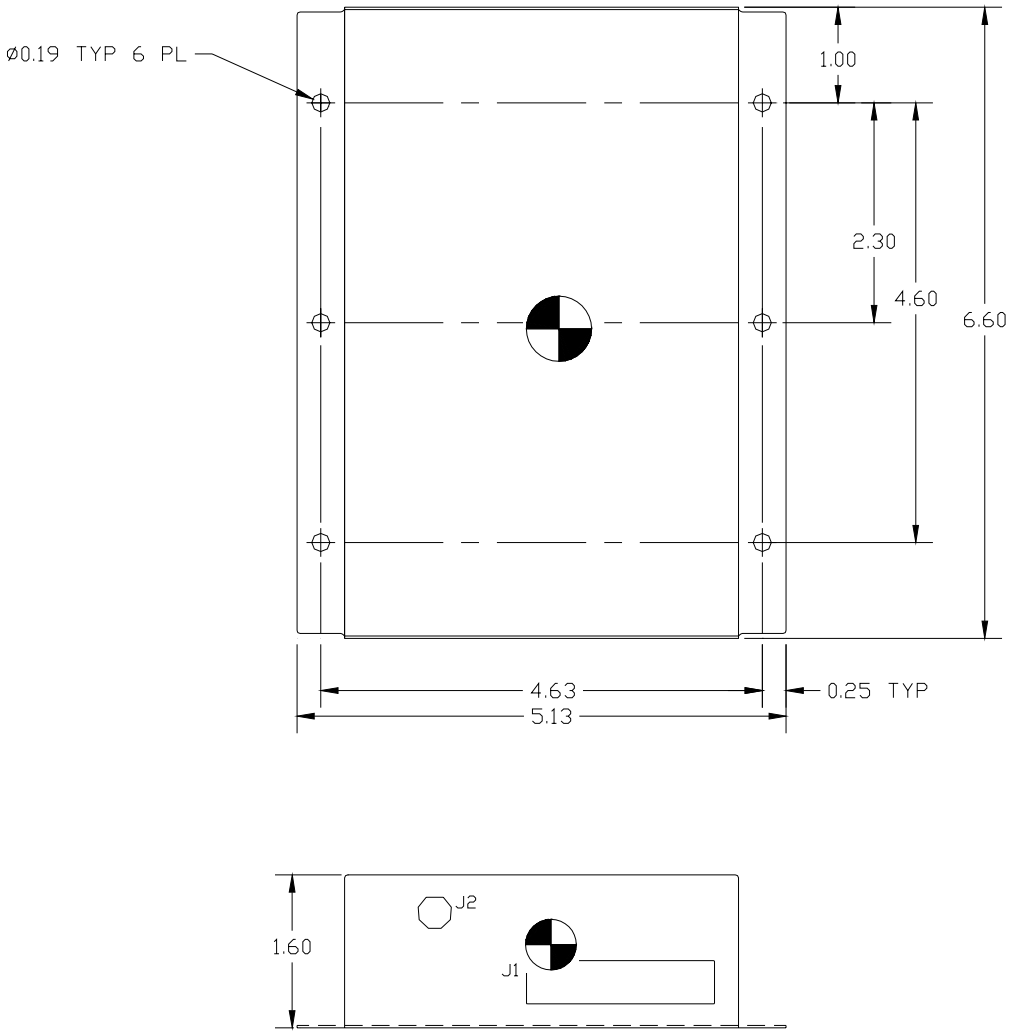


EFIS Keyboard Cutout (KB01)

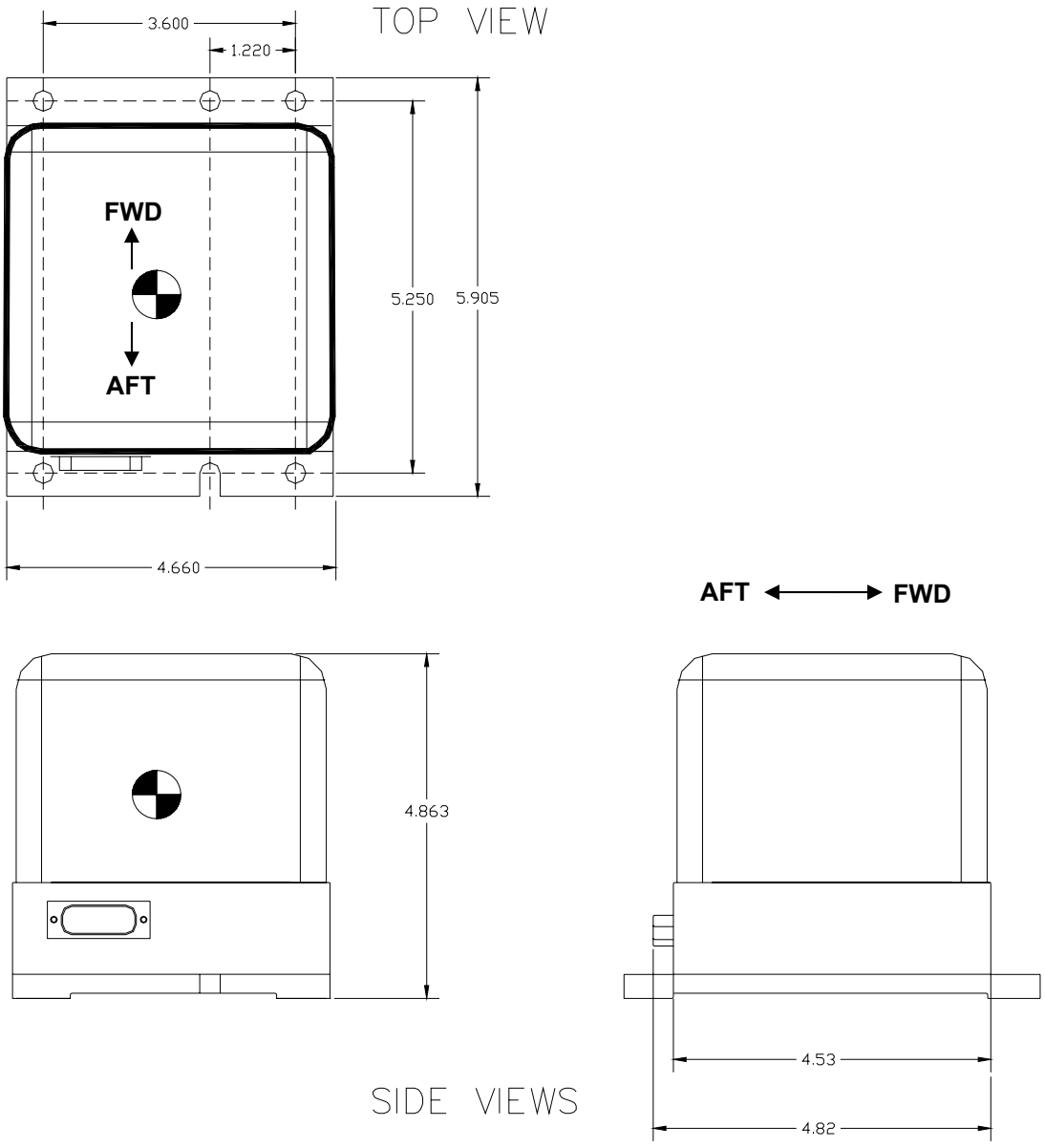


Toggle Switch Cutout for TAWS INHIBIT, G/S CANCEL, LOW ALT, ADC1/ADC2, AHRS1/AHRS2, GPS1/GPS2

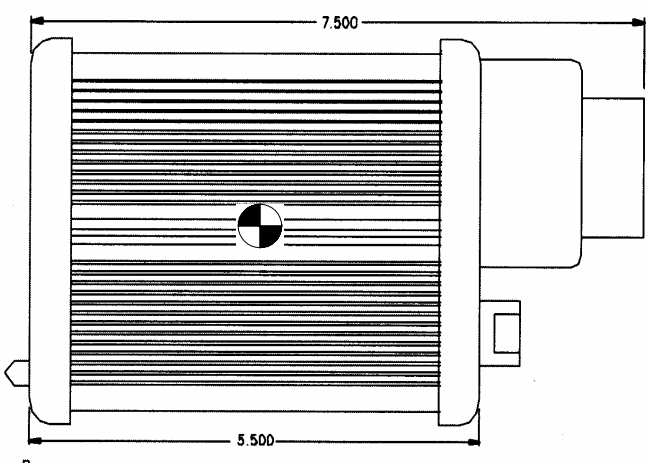
4.4 GPS MECHANICAL DRAWING



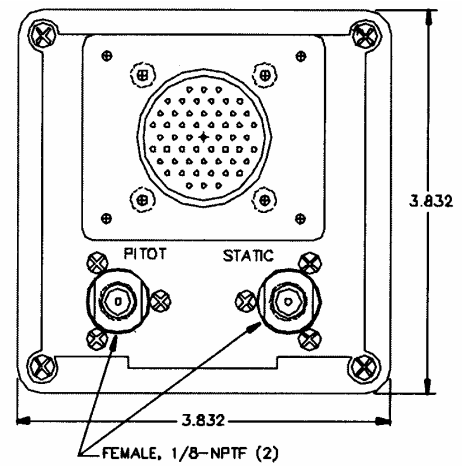
4.5 AHRS MECHANICAL DRAWING



4.6 ADC MECHANICAL DRAWING

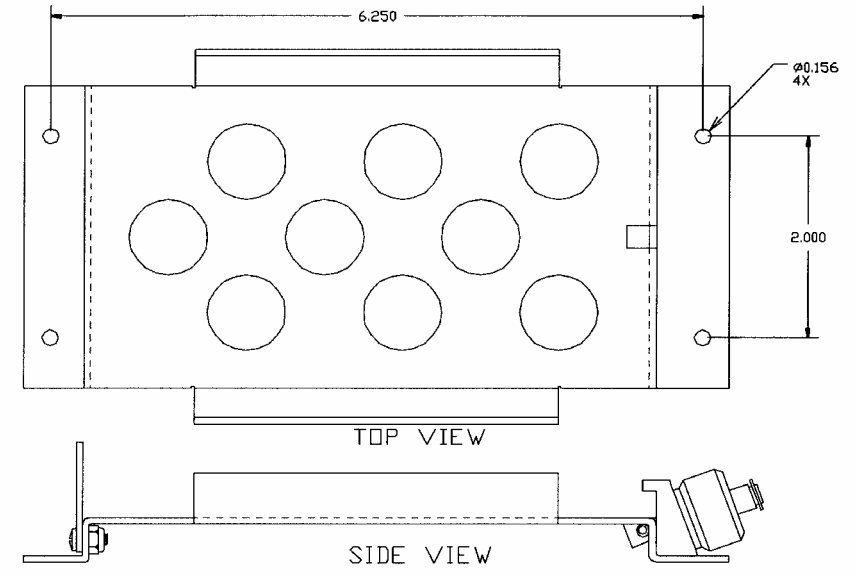


ADC Side View



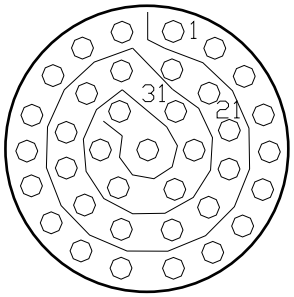
ADC Front View

ADC Mounting Tray



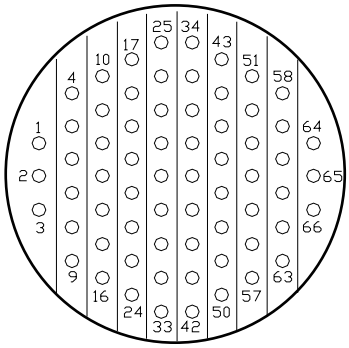
4.7 SYSTEM CONNECTOR PINOUTS

4.7A IDU P2 CONNECTOR



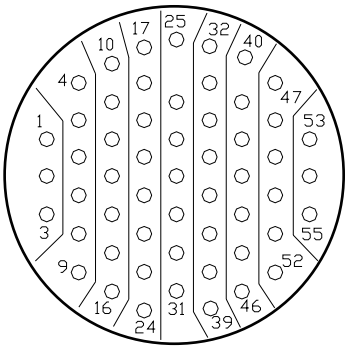
PIN	DESCRIPTION	PIN	DESCRIPTION
1	N/C	20	GROUND
2	N/C	21	GROUND
3	N/C	22	GROUND
4	REMOTE SELECT IN	23	GROUND
5	POWER	24	POWER GROUND
6	POWER	25	POWER GROUND
7	POWER	26	POWER GROUND
8	POWER	27	COM 21 (429) TXB
9	CRT VERTICAL OUT	28	COM 22 (429) TXB
10	CRT BLU OUT	29	COM 23 (429) TXB
11	CRT GREEN OUT	30	COM 24 (429) TXB
12	CRT RED OUT	31	POWER GROUND
13	CRT HORIZONTAL OUT	32	GROUND
14	COM 21 (429) TXA	33	GROUND
15	COM 22 (429) TXA	34	GROUND
16	COM 23 (429) TXA	35	GROUND
17	COM 24 (429) TXA	36	GROUND
18	UPS OUT (RESERVED)	37	GROUND
19	GROUND		

4.7B IDU P3/P4 CONNECTOR



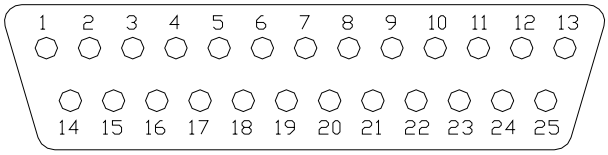
PIN	DESCRIPTION	PIN	DESCRIPTION
1	KEYBOARD POWER (+5V)	34	COM 17 (232) RX
2	KEYBOARD DATA	35	COM 16 (232) RX
3	DISCRETE 05	36	COM 17 (232) GND
4	BACKLIGHT REFERENCE	37	COM 16 (232) GND
5	AUDIO OUT	38	COM 13 (232) GND
6	KEYBOARD CLOCK	39	GROUND
7	DISCRETE 06	40	COM 01 (232) GND
8	DISCRETE 04	41	COM 09 (422) TXA
9	DISCRETE 02	42	COM 09 (422) TXB
10	MUTE IN	43	COM 15 (232) RX
11	BACKLIGHT	44	COM 13 (232) RX
12	5 VDC OUT	45	COM 15 (232) GND
13	AUDIO LOW	46	COM 14 (232) GND
14	KEYBOARD GROUND	47	COM 04 (232) GND
15	DISCRETE 03	48	COM 02 (232) GND
16	DISCRETE 01	49	COM 09 (422) RXA
17	COM 20 (232) RX	50	COM 09 (422) RXB
18	WARNING OUT	51	COM 14 (232) RX
19	COM 20 (232) GND	52	COM 06 (232) TX
20	GROUND	53	COM 06 (232) GND
21	GROUND	54	COM 05 (232) GND
22	GROUND	55	COM 03 (232) GND
23	COM 22 (429) RXA	56	COM 01 (232) RX
24	COM 22 (429) RXB	57	COM 01 (232) TX
25	COM 19 (232) RX	58	COM 06 (232) RX
26	COM 18 (232) RX	59	COM 05 (232) RX
27	COM 19 (232) GND	60	COM 04 (232) RX
28	COM 18 (232) GND	61	COM 03 (232) RX
29	GROUND	62	COM 02 (232) RX
30	GROUND	63	COM 02 (232) TX
31	GROUND	64	COM 05 (232) TX
32	COM 21 (429) RXA	65	COM 04 (232) TX
33	COM 21 (429) RXB	66	COM 03 (232) TX

4.7C IDU P5/P6 CONNECTOR



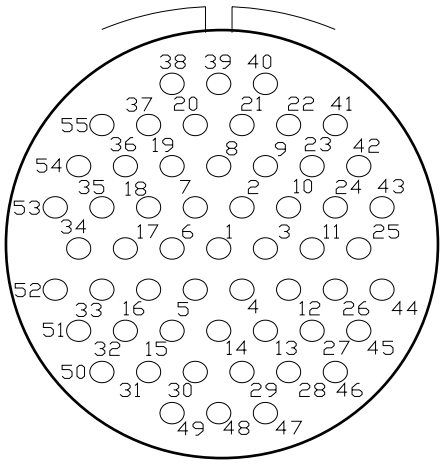
PIN	DESCRIPTION	PIN	DESCRIPTION
1	COM 07 (232) RX	29	GROUND
2	COM 08 (232) TX	30	GROUND
3	DISCRETE 10	31	COM 28 (429) RXB
4	COM 10 (422) TXA	32	COM 11 (422) TXA
5	COM 10 (422) TXB	33	COM 11 (422) TXB
6	COM 07 (232) TX	34	GROUND
7	COM 08 (232) RX	35	GROUND
8	DISCRETE 09	35	GROUND
9	DISCRETE 08	37	GROUND
10	COM 10 (422) RXB	38	N/C
11	N/C	39	COM 27 (429) RXA
12	COM 07 (232) GND	40	COM 12 (422) TXB
13	COM 08 (232) GND	41	COM 12 (422) RXB
14	GROUND	42	GROUND
15	N/C	43	GROUND
16	DISCRETE 07	44	COM 08 (232) GND
17	COM 10 (422) RXA	45	COM 26 (429) RXB
18	COM 11 (422) RXB	46	COM 27 (429) RXB
19	GROUND	47	COM 12 (422) TXA
20	GROUND	48	COM 12 (422) RXA
21	GROUND	49	COM 23 (429) RXA
22	GROUND	50	COM 24 (429) RXA
23	N/C	51	COM 25 (429) RXA
24	COM 28 (429) RXA	52	COM 26 (429) RXA
25	COM 11 (422) RXA	53	COM 23 (429) RXB
26	GROUND	54	COM 24 (429) RXB
27	GROUND	55	COM 25 (429) RXB
28	GROUND		

4.7D GPS P1 CONNECTOR



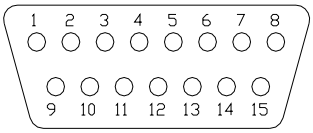
PIN	DESCRIPTION	PIN	DESCRIPTION
1	N/C	14	N/C
2	1 PPS A	15	1 PPS B
3	N/C	16	N/C
4	N/C	17	N/C
5	SHIELD 1	18	SHIELD 2
6	POWER INPUT	19	POWER RETURN
7	RS 232 TX2	20	RS 232 RX2
8	RS 232 TX1	21	RS 232 RX1
9	TX1 COMMON	22	RX1 COMMON
10	TX2 COMMON	23	RX2 COMMON
11	N/C	24	N/C
12	N/C	25	N/C
13	N/C		

4.7E ADC P1 CONNECTOR



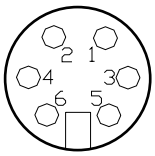
PIN	DESCRIPTION	PIN	DESCRIPTION
1	N/C	29	N/C
2	HEADING Y-SYNC INPUT	30	N/C
3	N/C	31	N/C
4	SHIELD GROUND	32	N/C
5	BARO INPUT +	33	OAT SIGNAL
6	N/C	34	N/C
7	HEADING X-SYNC INPUT	35	HEADING 26 VAC (C)
8	N/C	36	TX RS422 (+)
9	RS232 TX2	37	FLAG (RESERVED)
10	LEFT FF TXDR GROUND	38	RX RS422 (+)
11	N/C	39	RX RS232
12	LEFT DIGITAL FF INPUT	40	ARINC 429 A (+)
13	N/C	41	N/C
14	N/C	42	RX RS232
15	N/C	43	FUEL FLOW POWER
16	BARO INPUT (-)	44	N/C
17	N/C	45	N/C
18	HEADING 26 VAC. H	46	N/C
19	TX RS 422 (-)	47	N/C
20	RX RS422 (-)	48	N/C
21	TX RS232	49	N/C
22	ARINC 429 B (-)	50	N/C
23	RIGHT FF TXDR GROUND	51	N/C
24	RIGHT DIGITAL FF INPUT	52	OAT POWER
25	N/C	53	BARO WIPER
26	FUEL FLOW POWER	54	POWER GROUND
27	N/C	55	12 - 28 VDC INPUT
28	N/C		

4.7F AHRS P1 CONNECTOR



PIN	DESCRIPTION	PIN	DESCRIPTION
1	RS 232 TX	9	SIGNAL GROUND
2	RS 232 RX	10	N/C
3	10-40 VDC POWER INPUT	11	N/C
4	POWER INPUT GROUND	12	N/C
5	N/C	13	HARDWARE BIT STATUS
6	N/C	14	RS 422 RXA (+)
7	RS 422 TXA (+)	15	RS 422 RXA (+)
8	RS 422 TXA (-)		

4.7G KEYBOARD CONNECTOR



NOTE: *The connector pinout should be viewed as if looking at the wire end. The rectangular key is physically located on the mating end of the connector and is hidden from view when looking at the wire end. It is included in this drawing as a reference to pin numbers only.*

PIN	DESCRIPTION	WIRE COLOR
1	DATA	BLACK
2	NC	WHITE
3	GROUND	RED
4	POWER	GREEN
5	CLOCK	BROWN
6	NC	BLUE

NOTE: *Wire color code is for keyboard connector P/N MD66FJF.*

4.8 EFIS Wiring Diagram

Wiring Diagrams

The following drawings are simplified for reference. Refer to drawings 702-045250 (EFIS Interface) and 702-045251 (Aircraft System Interface) for complete requirements and specifications to the electrical installation of the EFIS system on an aircraft.

Installation Kits

Installation kits will vary depending on the EFIS system installed on the aircraft. The kits are:

149-045264-01 for the PFD
149-045264-02 for each MFD
149-045264-03 for a multi-sensor installation option
149-045264-04 for optional PFD sensors
149-045264-05 for optional MFD sensors

NOTE: *All electrical hardware needed for the installation is provided with each kit. The installer will be required to furnish wire, circuit breakers, and fasteners.*

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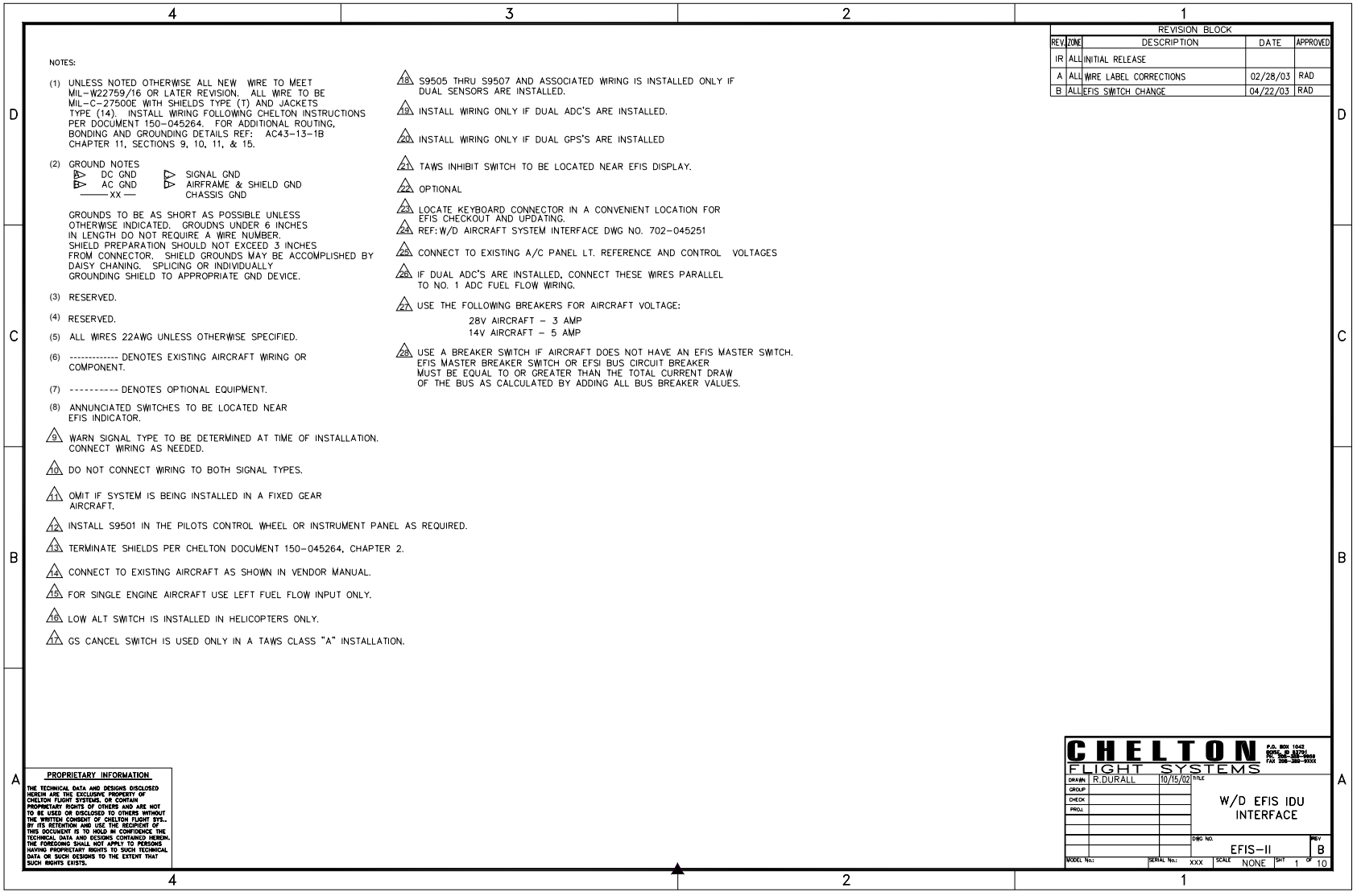


REVISION BLOCK				
REV.	ZONE	DESCRIPTION	DATE	APPROVED
IR	ALL	INITIAL RELEASE		
A	ALL	WIRE LABEL CORRECTIONS	02/28/03	RAD
B	ALL	EFIS SWITCH CHANGE	04/22/03	RAD

NOTES:

(1) UNLESS NOTED OTHERWISE ALL NEW WIRE TO MEET MIL-W22759/16 OR LATER REVISION. ALL WIRE TO BE MIL-C-27500E WITH SHIELDS TYPE (T) AND JACKETS TYPE (14). INSTALL WIRING FOLLOWING CHELTON INSTRUCTIONS PER DOCUMENT 150-045264. FOR ADDITIONAL ROUTING, BONDING AND GROUNDING DETAILS REF: AC43-13-1B CHAPTER 11, SECTIONS 9, 10, 11, & 15.

(2) GROUND NOTES
DC GND — SIGNAL GND
AC GND — AIRFRAME & SHIELD GND
—— XX —— CHASSIS GND

GROUNDS TO BE AS SHORT AS POSSIBLE UNLESS OTHERWISE INDICATED. GROUDNS UNDER 6 INCHES IN LENGTH DO NOT REQUIRE A WIRE NUMBER. SHIELD PREPARATION SHOULD NOT EXCEED 3 INCHES FROM CONNECTOR. SHIELD GROUNDS MAY BE ACCOMPLISHED BY DAISY CHANING. SPLICING OR INDIVIDUALLY GROUNDING SHIELD TO APPROPRIATE GND DEVICE.

(3) RESERVED.

(4) RESERVED.

(5) ALL WIRES 22AWG UNLESS OTHERWISE SPECIFIED.

(6) ---------- DENOTES EXISTING AIRCRAFT WIRING OR COMPONENT.

(7) ---------- DENOTES OPTIONAL EQUIPMENT.

(8) ANNUNCIATED SWITCHES TO BE LOCATED NEAR EFIS INDICATOR.

△9 WARN SIGNAL TYPE TO BE DETERMINED AT TIME OF INSTALLATION. CONNECT WIRING AS NEEDED.

△10 DO NOT CONNECT WIRING TO BOTH SIGNAL TYPES.

△11 OMIT IF SYSTEM IS BEING INSTALLED IN A FIXED GEAR AIRCRAFT.

△12 INSTALL S9501 IN THE PILOTS CONTROL WHEEL OR INSTRUMENT PANEL AS REQUIRED.

△13 TERMINATE SHIELDS PER CHELTON DOCUMENT 150-045264, CHAPTER 2.

△14 CONNECT TO EXISTING AIRCRAFT AS SHOWN IN VENDOR MANUAL.

△15 FOR SINGLE ENGINE AIRCRAFT USE LEFT FUEL FLOW INPUT ONLY.

△16 LOW ALT SWITCH IS INSTALLED IN HELICOPTERS ONLY.

△17 GS CANCEL SWITCH IS USED ONLY IN A TAWS CLASS "A" INSTALLATION.

△18 S9505 THRU S9507 AND ASSOCIATED WIRING IS INSTALLED ONLY IF DUAL SENSORS ARE INSTALLED.

△19 INSTALL WIRING ONLY IF DUAL ADC'S ARE INSTALLED.

△20 INSTALL WIRING ONLY IF DUAL GPS'S ARE INSTALLED

△21 TAWS INHIBIT SWITCH TO BE LOCATED NEAR EFIS DISPLAY.

△22 OPTIONAL

△23 LOCATE KEYBOARD CONNECTOR IN A CONVENIENT LOCATION FOR EFIS CHECKOUT AND UPDATING.

△24 REF: W/D AIRCRAFT SYSTEM INTERFACE DWG NO. 702-045251

△25 CONNECT TO EXISTING A/C PANEL LT. REFERENCE AND CONTROL VOLTAGES

△26 IF DUAL ADC'S ARE INSTALLED, CONNECT THESE WIRES PARALLEL TO NO. 1 ADC FUEL FLOW WIRING.

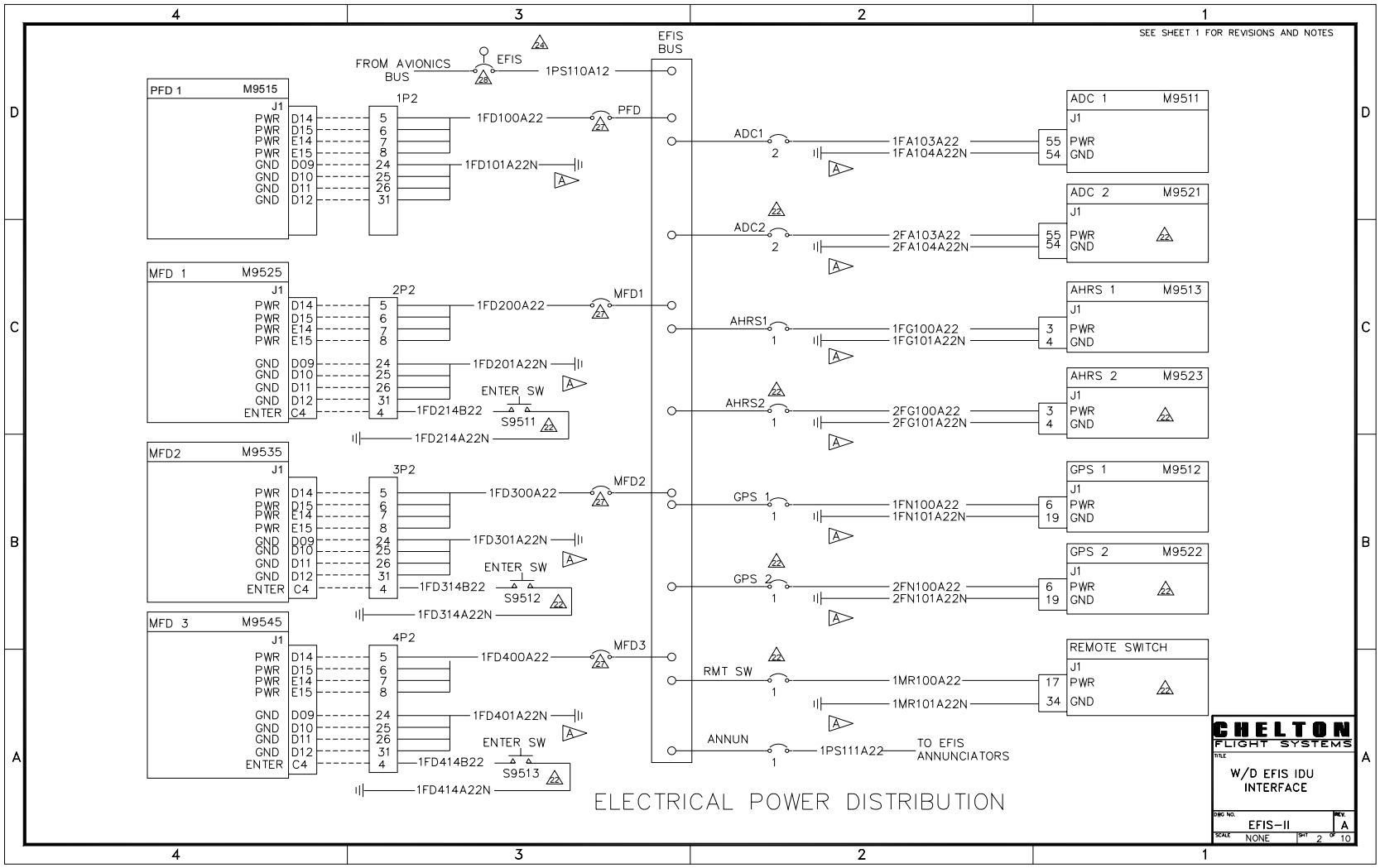
△27 USE THE FOLLOWING BREAKERS FOR AIRCRAFT VOLTAGE:
28V AIRCRAFT – 3 AMP
14V AIRCRAFT – 5 AMP

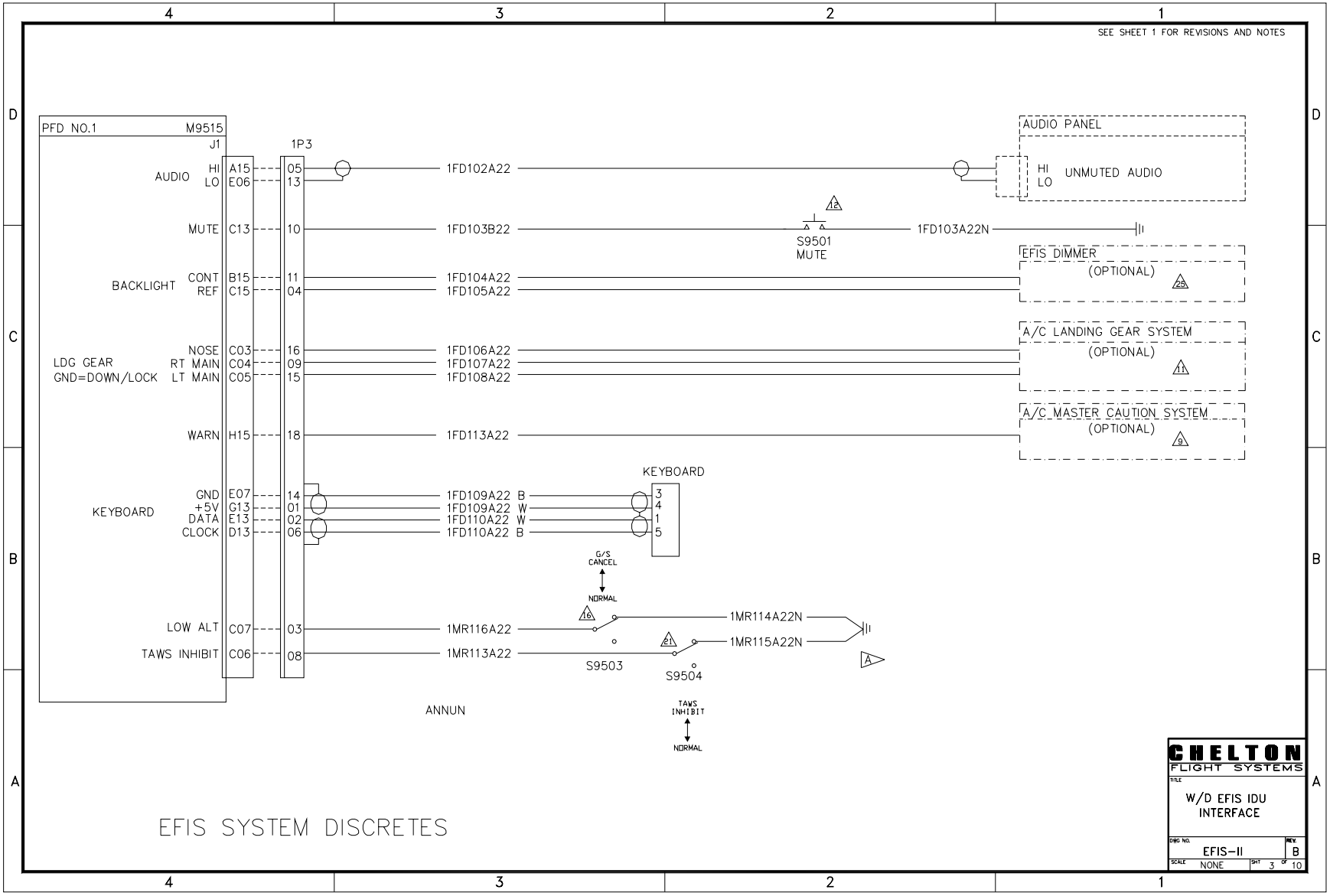
△28 USE A BREAKER SWITCH IF AIRCRAFT DOES NOT HAVE AN EFIS MASTER SWITCH. EFIS MASTER BREAKER SWITCH OR EFSI BUS CIRCUIT BREAKER MUST BE EQUAL TO OR GREATER THAN THE TOTAL CURRENT DRAW OF THE BUS AS CALCULATED BY ADDING ALL BUS BREAKER VALUES.

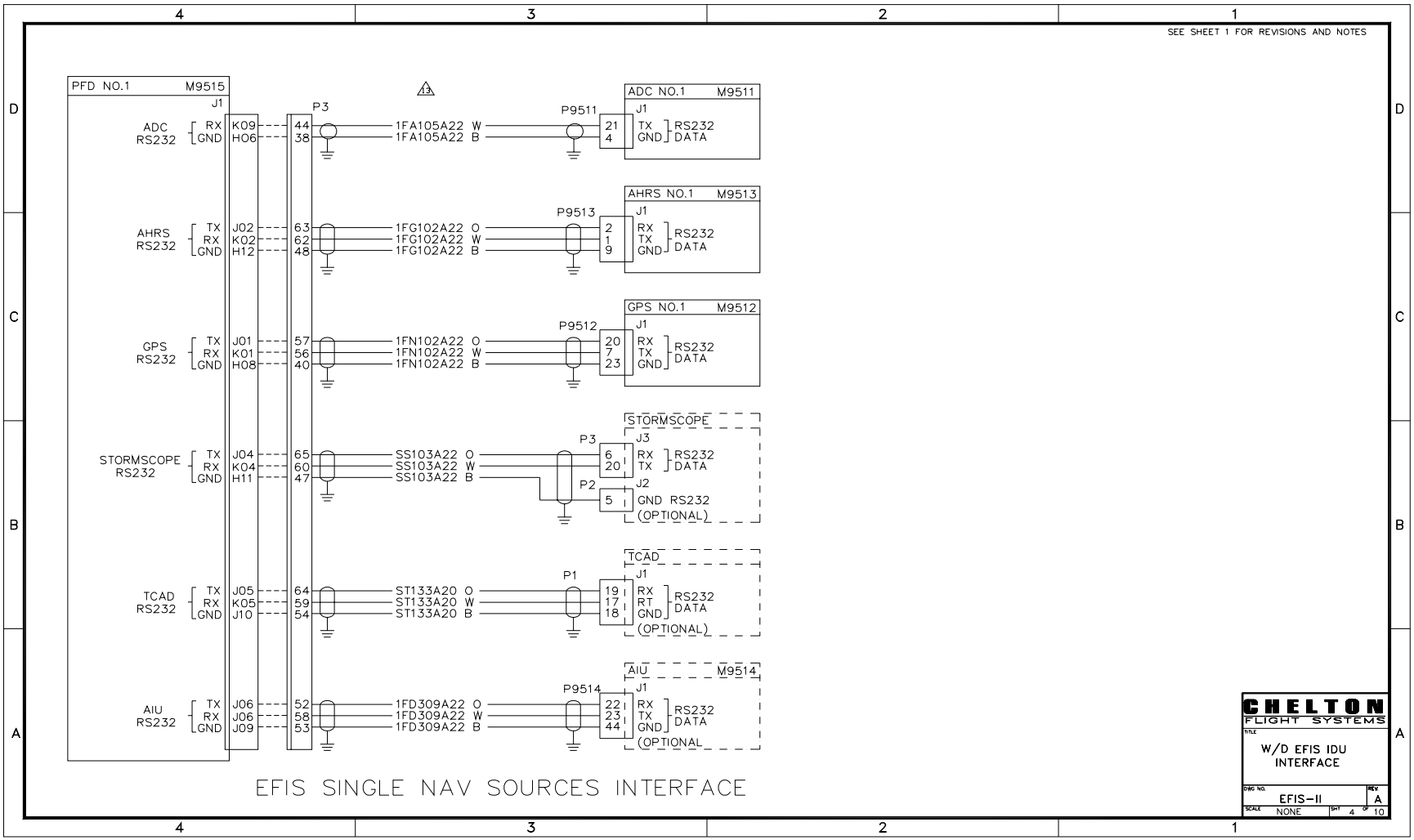
CHELTON FLIGHT SYSTEMS
P.O. BOX 1042
BOISE, ID 83701
PH: 208-388-9969
FAX 208-388-9XXX

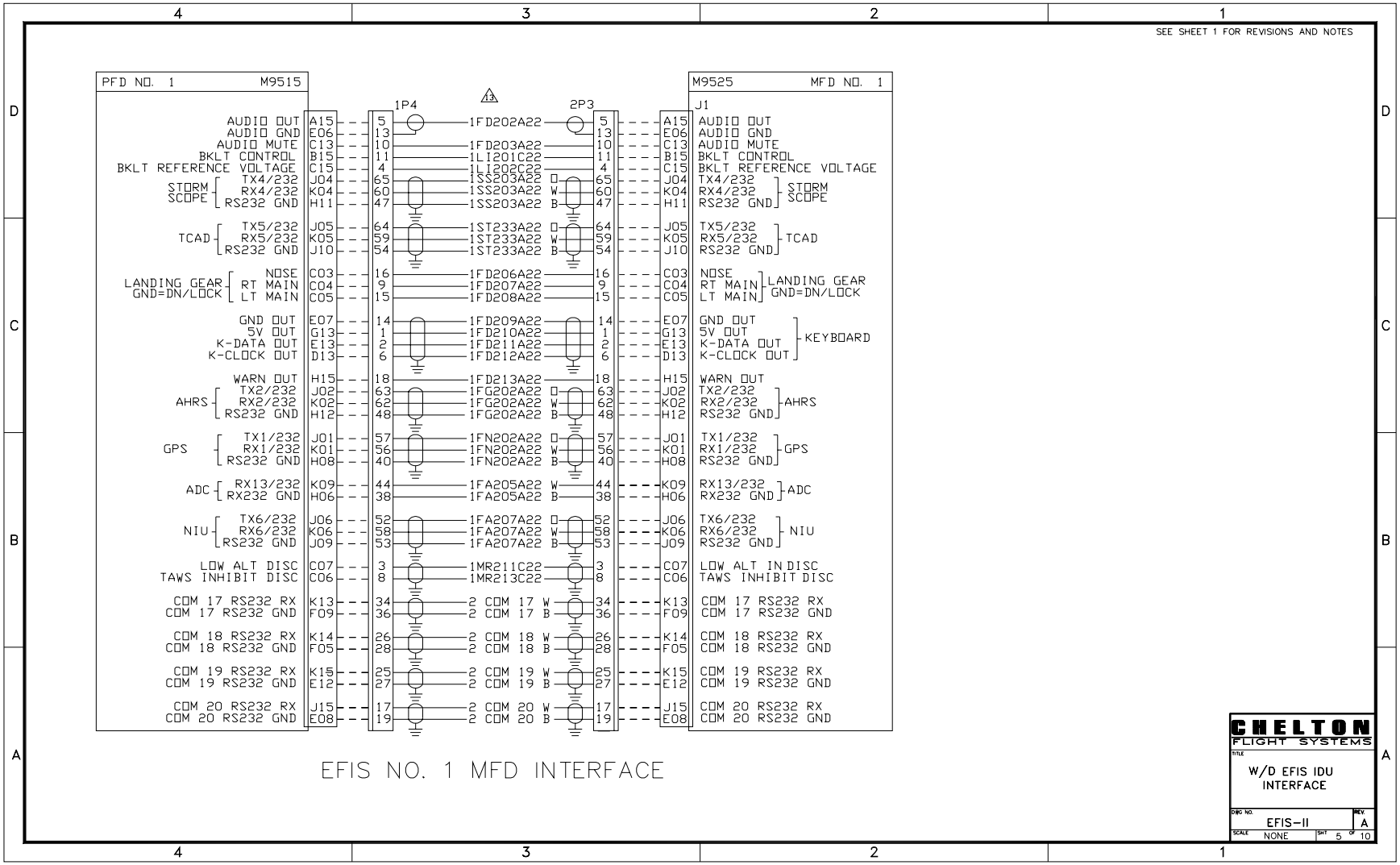
DRAWN	R.DURALL	10/15/02
GROUP		
CHECK		
PROJ.		

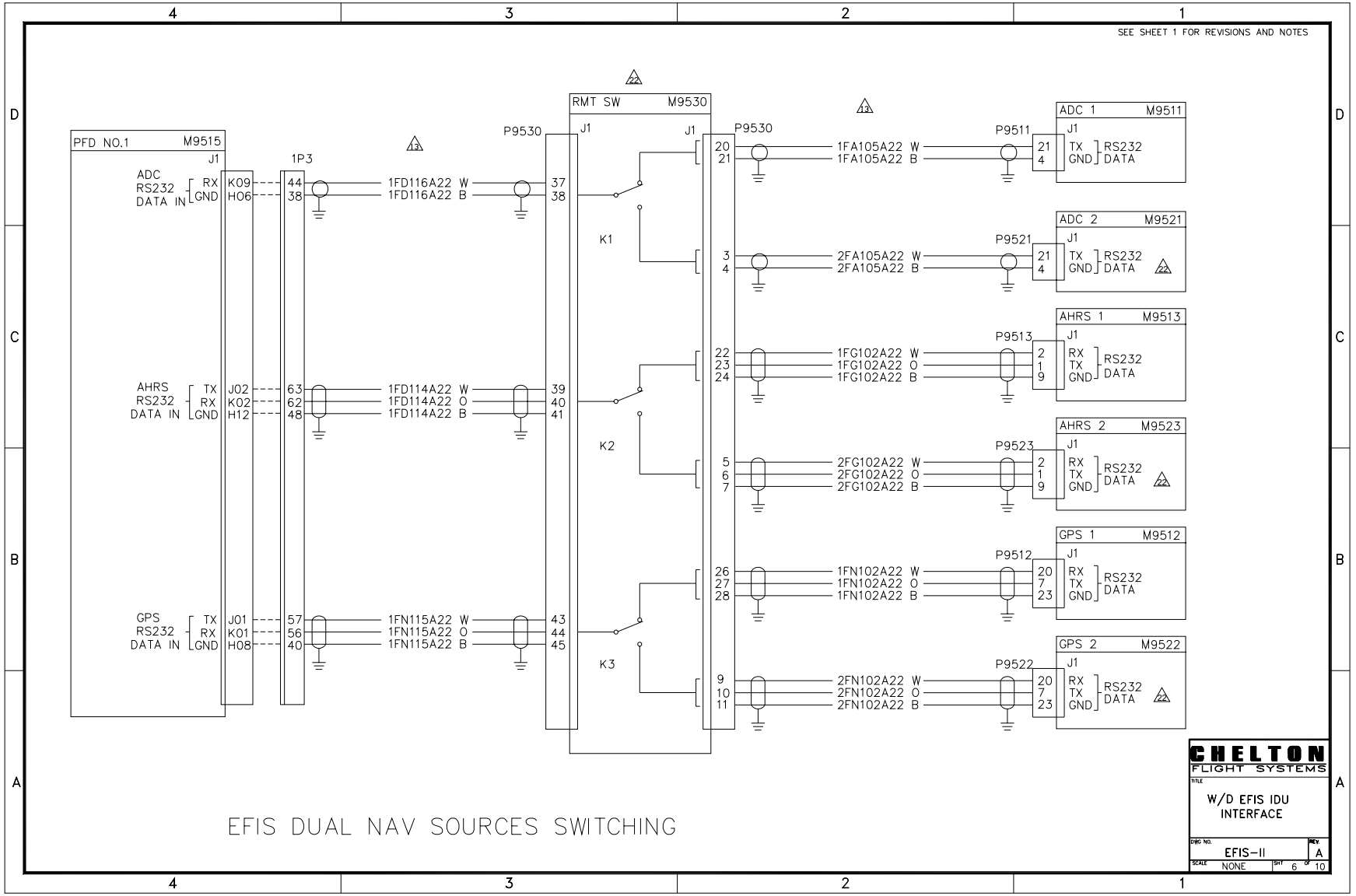
TITLE: W/D EFIS IDU INTERFACE
DWG NO.: EFIS-II
REV: B
MODEL No.: SERIAL No.: XXX
SCALE: NONE
SHT 1 OF 10

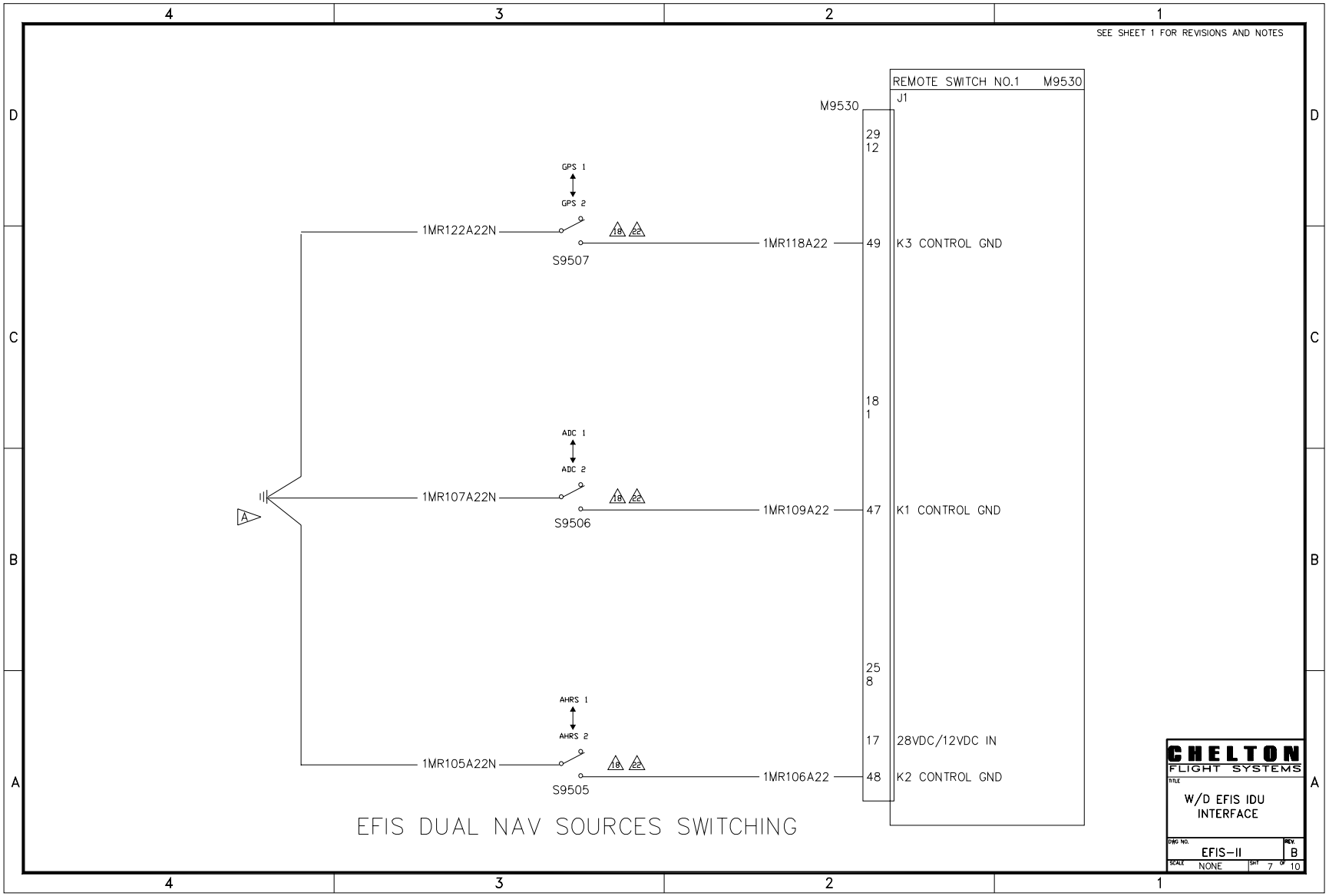

SEE SHEET 1 FOR REVISIONS AND NOTES
EFIS BUS
FROM AVIONICS BUS
EFIS
1PS110A12
PFD 1 M9515
1P2
1FD100A22
PFD
1FD101A22N
MFD 1 M9525
2P2
1FD200A22
MFD1
1FD201A22N
ENTER SW
S9511
1FD214B22
1FD214A22N
MFD2 M9535
3P2
1FD300A22
MFD2
1FD301A22N
ENTER SW
S9512
1FD314B22
1FD314A22N
MFD 3 M9545
4P2
1FD400A22
MFD3
1FD401A22N
ENTER SW
S9513
1FD414B22
1FD414A22N
ADC1
1FA103A22
1FA104A22N
ADC 1 M9511
ADC2
2FA103A22
2FA104A22N
ADC 2 M9521
AHRS1
1FG100A22
1FG101A22N
AHRS 1 M9513
AHRS2
2FG100A22
2FG101A22N
AHRS 2 M9523
GPS 1
1FN100A22
1FN101A22N
GPS 1 M9512
GPS 2
2FN100A22
2FN101A22N
GPS 2 M9522
RMT SW
1MR100A22
1MR101A22N
REMOTE SWITCH
ANNUN
1PS111A22
TO EFIS ANNUNCIATORS
ELECTRICAL POWER DISTRIBUTION
CHELTON FLIGHT SYSTEMS
W/D EFIS IDU INTERFACE
EFIS-II
A
NONE
2 OF 10

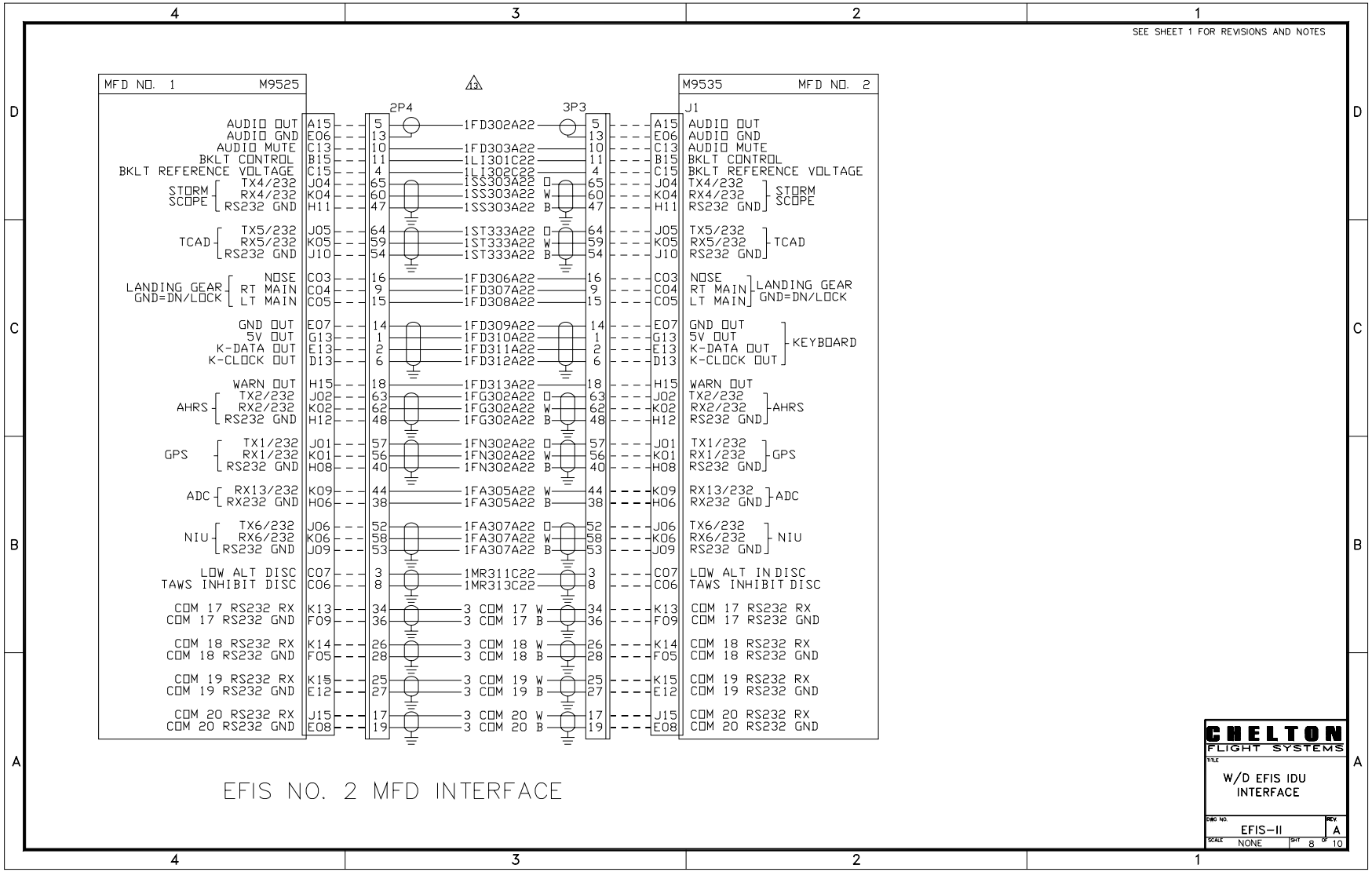

SEE SHEET 1 FOR REVISIONS AND NOTES
PFD NO.1
M9515
J1
1P3
AUDIO HI A15 05 1FD102A22
LO E06 13
AUDIO PANEL
HI
LO
UNMUTED AUDIO
MUTE C13 10 1FD103B22
S9501
MUTE
1FD103A22N
BACKLIGHT CONT B15 11 1FD104A22
REF C15 04 1FD105A22
EFIS DIMMER
(OPTIONAL)
LDG GEAR
GND=DOWN/LOCK
NOSE C03 16 1FD106A22
RT MAIN C04 09 1FD107A22
LT MAIN C05 15 1FD108A22
A/C LANDING GEAR SYSTEM
(OPTIONAL)
WARN H15 18 1FD113A22
A/C MASTER CAUTION SYSTEM
(OPTIONAL)
KEYBOARD
KEYBOARD GND E07 14 1FD109A22 B
+5V G13 01 1FD109A22 W
DATA E13 02 1FD110A22 W
CLOCK D13 06 1FD110A22 B
G/S CANCEL
NORMAL
LOW ALT C07 03 1FD116A22
TAWS INHIBIT C06 08 1MR113A22
1MR114A22N
1MR115A22N
S9503
S9504
ANNUN
TAWS INHIBIT
NORMAL
CHELTON
FLIGHT SYSTEMS
W/D EFIS IDU INTERFACE
DWG NO. EFIS-II
REV. B
SCALE NONE
SHT 3 OF 10
EFIS SYSTEM DISCRETES

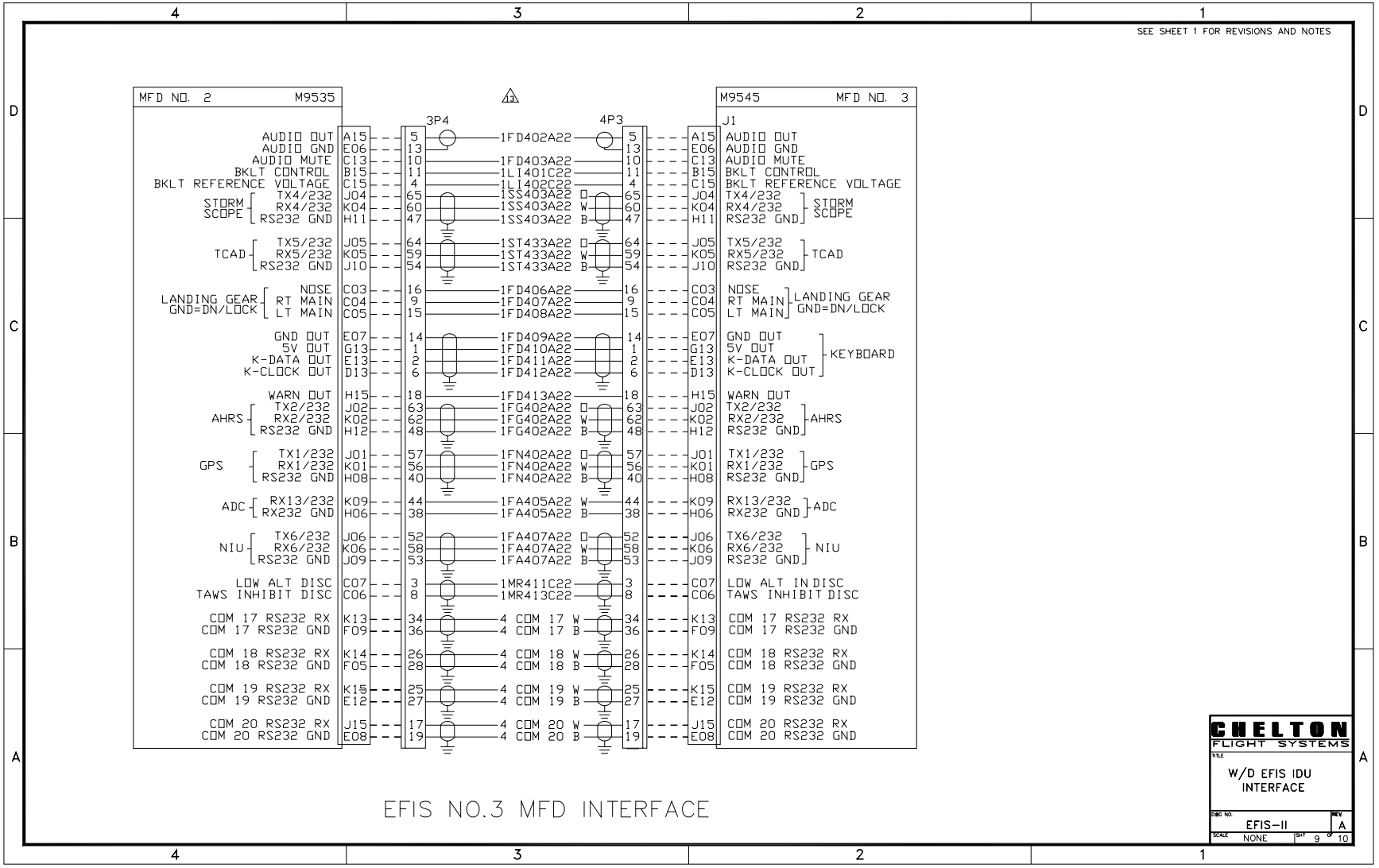

SEE SHEET 1 FOR REVISIONS AND NOTES
PFD NO.1 M9515
J1
ADC RS232
RX K09 44 1FA105A22 W
GND H06 38 1FA105A22 B
P3
P9511
ADC NO.1 M9511
J1
21 TX
4 GND
RS232 DATA
AHRS RS232
TX J02 63 1FG102A22 O
RX K02 62 1FG102A22 W
GND H12 48 1FG102A22 B
P9513
AHRS NO.1 M9513
2 RX
1 TX
9 GND
RS232 DATA
GPS RS232
TX J01 57 1FN102A22 O
RX K01 56 1FN102A22 W
GND H08 40 1FN102A22 B
P9512
GPS NO.1 M9512
20 RX
7 TX
23 GND
RS232 DATA
STORMSCOPE RS232
TX J04 65 SS103A22 O
RX K04 60 SS103A22 W
GND H11 47 SS103A22 B
STORMSCOPE
P3
J3
6 RX
20 TX
RS232 DATA
P2
J2
5 GND RS232
(OPTIONAL)
TCAD RS232
TX J05 64 ST133A20 O
RX K05 59 ST133A20 W
GND J10 54 ST133A20 B
TCAD
P1
J1
19 RX
17 RT
18 GND
RS232 DATA
(OPTIONAL)
AIU RS232
TX J06 52 1FD309A22 O
RX J06 58 1FD309A22 W
GND J09 53 1FD309A22 B
AIU M9514
P9514
J1
22 RX
23 TX
44 GND
RS232 DATA
(OPTIONAL
EFIS SINGLE NAV SOURCES INTERFACE
CHELTON
FLIGHT SYSTEMS
W/D EFIS IDU
INTERFACE
EFIS-II
A
NONE
4 OF 10

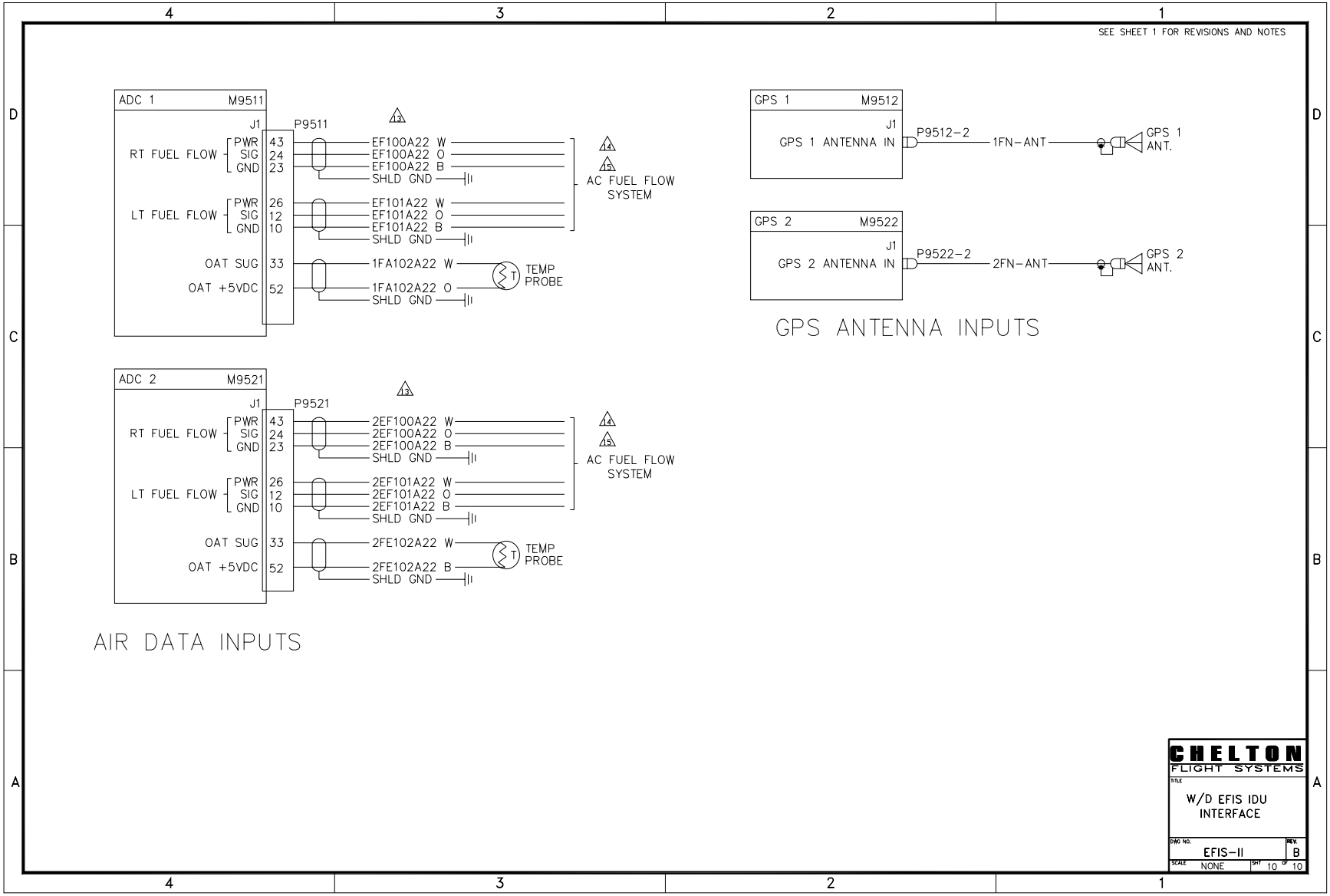

SEE SHEET 1 FOR REVISIONS AND NOTES
PFD NO. 1 M9515
M9525 MFD NO. 1
J1
1P4
2P3
AUDIO OUT A15 5 1FD202A22 5 A15 AUDIO OUT
AUDIO GND E06 13 13 E06 AUDIO GND
AUDIO MUTE C13 10 1FD203A22 10 C13 AUDIO MUTE
BKLT CONTROL B15 11 1LI201C22 11 B15 BKLT CONTROL
BKLT REFERENCE VOLTAGE C15 4 1LI202C22 4 C15 BKLT REFERENCE VOLTAGE
STORM SCOPE TX4/232 J04 65 1SS203A22 65 J04 TX4/232
RX4/232 K04 60 1SS203A22 W 60 K04 RX4/232 STORM
RS232 GND H11 47 1SS203A22 B 47 H11 RS232 GND SCOPE
TCAD TX5/232 J05 64 1ST233A22 64 J05 TX5/232
RX5/232 K05 59 1ST233A22 W 59 K05 RX5/232 TCAD
RS232 GND J10 54 1ST233A22 B 54 J10 RS232 GND
LANDING GEAR GND=DN/LOCK NOSE C03 16 1FD206A22 16 C03 NOSE
RT MAIN C04 9 1FD207A22 9 C04 RT MAIN LANDING GEAR
LT MAIN C05 15 1FD208A22 15 C05 LT MAIN GND=DN/LOCK
GND OUT E07 14 1FD209A22 14 E07 GND OUT
5V OUT G13 1 1FD210A22 1 G13 5V OUT
K-DATA OUT E13 2 1FD211A22 2 E13 K-DATA OUT KEYBOARD
K-CLOCK OUT D13 6 1FD212A22 6 D13 K-CLOCK OUT
WARN OUT H15 18 1FD213A22 18 H15 WARN OUT
AHRS TX2/232 J02 63 1FG202A22 63 J02 TX2/232
RX2/232 K02 62 1FG202A22 W 62 K02 RX2/232 AHRS
RS232 GND H12 48 1FG202A22 B 48 H12 RS232 GND
GPS TX1/232 J01 57 1FN202A22 57 J01 TX1/232
RX1/232 K01 56 1FN202A22 W 56 K01 RX1/232 GPS
RS232 GND H08 40 1FN202A22 B 40 H08 RS232 GND
ADC RX13/232 K09 44 1FA205A22 W 44 K09 RX13/232 ADC
RX232 GND H06 38 1FA205A22 B 38 H06 RX232 GND
NIU TX6/232 J06 52 1FA207A22 52 J06 TX6/232
RX6/232 K06 58 1FA207A22 W 58 K06 RX6/232 NIU
RS232 GND J09 53 1FA207A22 B 53 J09 RS232 GND
LOW ALT DISC C07 3 1MR211C22 3 C07 LOW ALT IN DISC
TAWS INHIBIT DISC C06 8 1MR213C22 8 C06 TAWS INHIBIT DISC
COM 17 RS232 RX K13 34 2 COM 17 W 34 K13 COM 17 RS232 RX
COM 17 RS232 GND F09 36 2 COM 17 B 36 F09 COM 17 RS232 GND
COM 18 RS232 RX K14 26 2 COM 18 W 26 K14 COM 18 RS232 RX
COM 18 RS232 GND F05 28 2 COM 18 B 28 F05 COM 18 RS232 GND
COM 19 RS232 RX K15 25 2 COM 19 W 25 K15 COM 19 RS232 RX
COM 19 RS232 GND E12 27 2 COM 19 B 27 E12 COM 19 RS232 GND
COM 20 RS232 RX J15 17 2 COM 20 W 17 J15 COM 20 RS232 RX
COM 20 RS232 GND E08 19 2 COM 20 B 19 E08 COM 20 RS232 GND
EFIS NO. 1 MFD INTERFACE
CHELTON FLIGHT SYSTEMS
W/D EFIS IDU INTERFACE
EFIS-II
A
NONE
5 OF 10


SEE SHEET 1 FOR REVISIONS AND NOTES
PFD NO.1 M9515
J1
ADC RS232 DATA IN
RX
GND
AHRS RS232 DATA IN
TX
RX
GND
GPS RS232 DATA IN
TX
RX
GND
K09
H06
J02
K02
H12
J01
K01
H08
1P3
P9530
RMT SW M9530
K1
K2
K3
1FD116A22 W
1FD116A22 B
1FD114A22 W
1FD114A22 O
1FD114A22 B
1FN115A22 W
1FN115A22 O
1FN115A22 B
1FA105A22 W
1FA105A22 B
2FA105A22 W
2FA105A22 B
1FG102A22 W
1FG102A22 O
1FG102A22 B
2FG102A22 W
2FG102A22 O
2FG102A22 B
1FN102A22 W
1FN102A22 O
1FN102A22 B
2FN102A22 W
2FN102A22 O
2FN102A22 B
ADC 1 M9511
ADC 2 M9521
AHRS 1 M9513
AHRS 2 M9523
GPS 1 M9512
GPS 2 M9522
P9511
P9521
P9513
P9523
P9512
P9522
TX
GND
RX
RS232 DATA
CHELTON
FLIGHT SYSTEMS
W/D EFIS IDU INTERFACE
EFIS-II
A
NONE
6 OF 10
EFIS DUAL NAV SOURCES SWITCHING


SEE SHEET 1 FOR REVISIONS AND NOTES
REMOTE SWITCH NO.1 M9530
J1
M9530
29
12
18
1
25
8
GPS 1
GPS 2
1MR122A22N
S9507
1MR118A22
49
K3 CONTROL GND
ADC 1
ADC 2
1MR107A22N
S9506
1MR109A22
47
K1 CONTROL GND
AHRS 1
AHRS 2
1MR105A22N
S9505
1MR106A22
48
K2 CONTROL GND
17
28VDC/12VDC IN
EFIS DUAL NAV SOURCES SWITCHING
CHELTON
FLIGHT SYSTEMS
W/D EFIS IDU
INTERFACE
EFIS-II
B
NONE
7
10


SEE SHEET 1 FOR REVISIONS AND NOTES
MFD NO. 1 M9525
M9535 MFD NO. 2
2P4
3P3
J1
AUDIO OUT A15 5 1FD302A22 5 A15 AUDIO OUT
AUDIO GND E06 13 13 E06 AUDIO GND
AUDIO MUTE C13 10 1FD303A22 10 C13 AUDIO MUTE
BKLT CONTROL B15 11 1LI301C22 11 B15 BKLT CONTROL
BKLT REFERENCE VOLTAGE C15 4 1LI302C22 4 C15 BKLT REFERENCE VOLTAGE
STORM/SCOPE TX4/232 J04 65 1SS303A22 65 J04 TX4/232
RX4/232 K04 60 1SS303A22 W 60 K04 RX4/232
RS232 GND H11 47 1SS303A22 B 47 H11 RS232 GND
TCAD TX5/232 J05 64 1ST333A22 64 J05 TX5/232
RX5/232 K05 59 1ST333A22 W 59 K05 RX5/232
RS232 GND J10 54 1ST333A22 B 54 J10 RS232 GND
LANDING GEAR GND=DN/LOCK NOSE C03 16 1FD306A22 16 C03 NOSE
RT MAIN C04 9 1FD307A22 9 C04 RT MAIN
LT MAIN C05 15 1FD308A22 15 C05 LT MAIN
GND OUT E07 14 1FD309A22 14 E07 GND OUT
5V OUT G13 1 1FD310A22 1 G13 5V OUT
K-DATA OUT E13 2 1FD311A22 2 E13 K-DATA OUT
K-CLOCK OUT D13 6 1FD312A22 6 D13 K-CLOCK OUT
KEYBOARD
WARN OUT H15 18 1FD313A22 18 H15 WARN OUT
AHRS TX2/232 J02 63 1FG302A22 63 J02 TX2/232
RX2/232 K02 62 1FG302A22 W 62 K02 RX2/232
RS232 GND H12 48 1FG302A22 B 48 H12 RS232 GND
GPS TX1/232 J01 57 1FN302A22 57 J01 TX1/232
RX1/232 K01 56 1FN302A22 W 56 K01 RX1/232
RS232 GND H08 40 1FN302A22 B 40 H08 RS232 GND
ADC RX13/232 K09 44 1FA305A22 W 44 K09 RX13/232
RX232 GND H06 38 1FA305A22 B 38 H06 RX232 GND
NIU TX6/232 J06 52 1FA307A22 52 J06 TX6/232
RX6/232 K06 58 1FA307A22 W 58 K06 RX6/232
RS232 GND J09 53 1FA307A22 B 53 J09 RS232 GND
LOW ALT DISC C07 3 1MR311C22 3 C07 LOW ALT IN DISC
TAWS INHIBIT DISC C06 8 1MR313C22 8 C06 TAWS INHIBIT DISC
COM 17 RS232 RX K13 34 3 COM 17 W 34 K13 COM 17 RS232 RX
COM 17 RS232 GND F09 36 3 COM 17 B 36 F09 COM 17 RS232 GND
COM 18 RS232 RX K14 26 3 COM 18 W 26 K14 COM 18 RS232 RX
COM 18 RS232 GND F05 28 3 COM 18 B 28 F05 COM 18 RS232 GND
COM 19 RS232 RX K15 25 3 COM 19 W 25 K15 COM 19 RS232 RX
COM 19 RS232 GND E12 27 3 COM 19 B 27 E12 COM 19 RS232 GND
COM 20 RS232 RX J15 17 3 COM 20 W 17 J15 COM 20 RS232 RX
COM 20 RS232 GND E08 19 3 COM 20 B 19 E08 COM 20 RS232 GND
EFIS NO. 2 MFD INTERFACE
CHELTON FLIGHT SYSTEMS
TITLE
W/D EFIS IDU INTERFACE
DWG NO. EFIS-II
REV. A
SCALE NONE
SHT 8 OF 10


SEE SHEET 1 FOR REVISIONS AND NOTES
MFD NO. 2 M9535
M9545 MFD NO. 3
J1
3P4
4P3
AUDIO OUT A15 5 1FD402A22 5 A15 AUDIO OUT
AUDIO GND E06 13 13 E06 AUDIO GND
AUDIO MUTE C13 10 1FD403A22 10 C13 AUDIO MUTE
BKLT CONTROL B15 11 1LI401C22 11 B15 BKLT CONTROL
BKLT REFERENCE VOLTAGE C15 4 1LI402C22 4 C15 BKLT REFERENCE VOLTAGE
STORM SCOPE TX4/232 J04 65 1SS403A22 65 J04 TX4/232
RX4/232 K04 60 1SS403A22 W 60 K04 RX4/232
RS232 GND H11 47 1SS403A22 B 47 H11 RS232 GND
TCAD TX5/232 J05 64 1ST433A22 64 J05 TX5/232
RX5/232 K05 59 1ST433A22 W 59 K05 RX5/232
RS232 GND J10 54 1ST433A22 B 54 J10 RS232 GND
LANDING GEAR GND=DN/LOCK NOSE C03 16 1FD406A22 16 C03 NOSE
RT MAIN C04 9 1FD407A22 9 C04 RT MAIN
LT MAIN C05 15 1FD408A22 15 C05 LT MAIN
GND OUT E07 14 1FD409A22 14 E07 GND OUT
5V OUT G13 1 1FD410A22 1 G13 5V OUT
K-DATA OUT E13 2 1FD411A22 2 E13 K-DATA OUT
K-CLOCK OUT D13 6 1FD412A22 6 D13 K-CLOCK OUT
WARN OUT H15 18 1FD413A22 18 H15 WARN OUT
AHRS TX2/232 J02 63 1FG402A22 63 J02 TX2/232
RX2/232 K02 62 1FG402A22 W 62 K02 RX2/232
RS232 GND H12 48 1FG402A22 B 48 H12 RS232 GND
GPS TX1/232 J01 57 1FN402A22 57 J01 TX1/232
RX1/232 K01 56 1FN402A22 W 56 K01 RX1/232
RS232 GND H08 40 1FN402A22 B 40 H08 RS232 GND
ADC RX13/232 K09 44 1FA405A22 W 44 K09 RX13/232
RX232 GND H06 38 1FA405A22 B 38 H06 RX232 GND
NIU TX6/232 J06 52 1FA407A22 52 J06 TX6/232
RX6/232 K06 58 1FA407A22 W 58 K06 RX6/232
RS232 GND J09 53 1FA407A22 B 53 J09 RS232 GND
LOW ALT DISC C07 3 1MR411C22 3 C07 LOW ALT IN DISC
TAWS INHIBIT DISC C06 8 1MR413C22 8 C06 TAWS INHIBIT DISC
COM 17 RS232 RX K13 34 4 COM 17 W 34 K13 COM 17 RS232 RX
COM 17 RS232 GND F09 36 4 COM 17 B 36 F09 COM 17 RS232 GND
COM 18 RS232 RX K14 26 4 COM 18 W 26 K14 COM 18 RS232 RX
COM 18 RS232 GND F05 28 4 COM 18 B 28 F05 COM 18 RS232 GND
COM 19 RS232 RX K15 25 4 COM 19 W 25 K15 COM 19 RS232 RX
COM 19 RS232 GND E12 27 4 COM 19 B 27 E12 COM 19 RS232 GND
COM 20 RS232 RX J15 17 4 COM 20 W 17 J15 COM 20 RS232 RX
COM 20 RS232 GND E08 19 4 COM 20 B 19 E08 COM 20 RS232 GND
STORM SCOPE
TCAD
LANDING GEAR GND=DN/LOCK
KEYBOARD
AHRS
GPS
ADC
NIU
EFIS NO.3 MFD INTERFACE
CHELTON FLIGHT SYSTEMS
TITLE
W/D EFIS IDU INTERFACE
DWG NO. EFIS-II
REV. A
SCALE NONE
SHT 9 OF 10


SEE SHEET 1 FOR REVISIONS AND NOTES
ADC 1 M9511
J1 P9511
RT FUEL FLOW
PWR 43 EF100A22 W
SIG 24 EF100A22 O
GND 23 EF100A22 B
SHLD GND
LT FUEL FLOW
PWR 26 EF101A22 W
SIG 12 EF101A22 O
GND 10 EF101A22 B
SHLD GND
OAT SUG 33 1FA102A22 W
OAT +5VDC 52 1FA102A22 O
SHLD GND
TEMP PROBE
AC FUEL FLOW SYSTEM
ADC 2 M9521
J1 P9521
RT FUEL FLOW
PWR 43 2EF100A22 W
SIG 24 2EF100A22 O
GND 23 2EF100A22 B
SHLD GND
LT FUEL FLOW
PWR 26 2EF101A22 W
SIG 12 2EF101A22 O
GND 10 2EF101A22 B
SHLD GND
OAT SUG 33 2FE102A22 W
OAT +5VDC 52 2FE102A22 B
SHLD GND
TEMP PROBE
AC FUEL FLOW SYSTEM
AIR DATA INPUTS
GPS 1 M9512
J1
GPS 1 ANTENNA IN
P9512-2
1FN-ANT
GPS 1 ANT.
GPS 2 M9522
J1
GPS 2 ANTENNA IN
P9522-2
2FN-ANT
GPS 2 ANT.
GPS ANTENNA INPUTS
CHELTON
FLIGHT SYSTEMS
TITLE
W/D EFIS IDU INTERFACE
DWG NO. EFIS-II
REV. B
SCALE NONE
SHT 10 OF 10

Chapter 5

EFIS Configuration

After the supporting components of the EFIS system have been installed and are functional, the system must be configured for the specific installation. The following section will explain in detail the individual steps and procedures required to tailor the EFIS to your installation.

NOTE: *All IDUs must be on for the keyboard to work. The keyboard will only operate with the IDU that contains the SmartMedia card.*

NOTE: *Insert SmartMedia card with gold contacts up.*

CAUTION
Due to the critical flight information provided by the EFIS system, DO NOT fly the aircraft until ALL Sections of the EFIS configuration are complete.

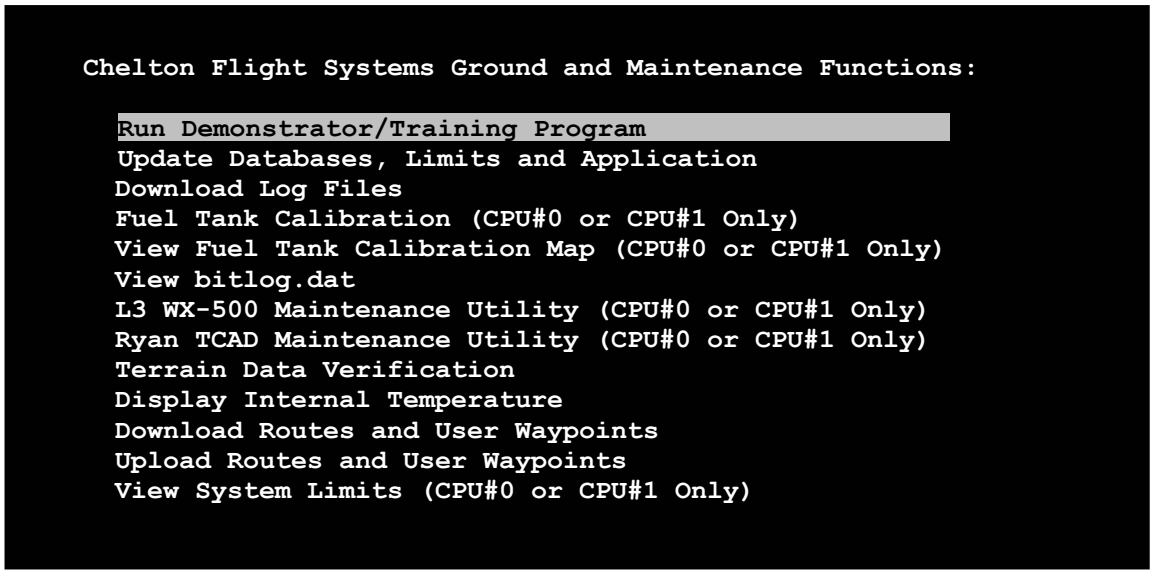
GROUND MAINTENANCE FUNCTIONS (GMF)

EFIS configuration is performed with the Ground and Maintenance Functions (GMF). To initiate the GMF, insert the data card into the data card slot of an IDU prior to applying power.

CAUTION
Do not insert or remove the data card with power applied to the IDU as this will damage the data card.

CAUTION
Do not use any SmartMedia card larger than 64MB. The IDU will not read or write data to the card.

After the card is completely inserted, apply power to the IDU. The IDU will sense the presence of the data card and the GMF will come up automatically as follows:



Select the desired menu option by rotating the right hand encoder until the selection is highlighted, then press in the right hand encoder to select. Each menu option is further described below.

RUN DEMONSTRATOR/TRAINING PROGRAM

Selecting option "Run Demonstrator/Training Program" option on the IDU will start the ground demonstration mode. The EFIS will start flying the demonstration once a flight plan has been evoked, and will start at the first waypoint of the flight plan and will fly to the last waypoint.

The program will always fly through the boxes or by evoking one of the bugs (heading or target altitude). All IDU controls are functional during the ground demonstration program. This allows the user to activate the menus and become familiar with the many features of the Chelton Flight Systems EFIS.

In addition to the IDU controls, the following keys can be toggled on an external keyboard during the ground demonstration loop to simulate failure modes:

0 = All Systems OK
1 = GPS Failure
2 = Air Data/Engine Data Failure
3 = AHRS Failure
4 = GPS and Air Data/Engine Data Failure
5 = GPS and AHRS Failure
6 = Air Data/Engine Data Failure and AHRS Failure
7 = GPS, Air Data/Engine Data and AHRS Failure

While the operator may never actually see a failure mode in flight, it is prudent to become familiar with the system's capabilities in the event of sensor failure.

Press "Q" key on the external keyboard or remove power from the IDU to quit the ground demonstration loop.

UPDATE DATABASES, LIMITS AND APPLICATION

Selecting the "Update Databases, Limits and Application" option on the IDU will start a system update. This function looks for the presence of update files on the data card. Update files are self-extracting zip files that unpack into certain locations of the IDU flash drives. CRC-32s are integral to the updates to assure the integrity of the data. Possible update files are as follows:

navdata.exe: This file updates navigation data files.

obst.exe: This file updates obstruction data files.

update.exe: This file updates application and ground maintenance function files.

limits.txt: This file contains all of the engine and airframe data that is required for proper flight display on the EFIS. See the IDU Limits Programming section later in this chapter for further detail.

During the update, applicable directories are wiped clean prior to updating to prevent the retention of obsolete and extraneous files. In addition, during execution of each update file, file integrity messages for each extracted file will appear on the screen, and the update function will pause after each update file has finished executing. The user should review the file integrity messages for indications of errors. After each pause, press any key to continue the updating process. Should an error be detected, take the following steps:

1. Continue with the update process until you are returned to the GMF main menu.
2. Power down the IDU and remove the data card.
3. Copy the applicable update files to the freshly formatted data card.
4. Re-attempt the update on the IDU.
5. If the update fails again, contact Chelton Flight Systems technical support.

After the update files execute, disk scanning and disk defragmentation utilities are run to verify flashdisk performance and to optimize the manner in which files are stored. The user is then returned to the GMF main menu.

As this function looks for the presence of update files and automatically runs the files without user prompting, it is important to

ensure that the data card inserted in the IDU contains the latest update files. Accordingly, it is a good idea to erase or reformat the data card prior to copying update files to it. This will ensure that no old files exist on the data card and will minimize the chance of data errors during updating.

NOTE: *Terrain data is too large to be updated by a data card.*

Updating terrain data requires that the IDU be removed from its tray to gain access to the terrain data flashdisk slot in the top cover of the IDU. The terrain data flashdisk is manually replaced with an updated unit from Chelton Flight Systems. Update of the Terrain data base is performed by an authorized Chelton Flight Systems dealer as needed. Chelton Flight Systems will provide announcements to its authorized dealers when updates to the Terrain data base are available.

(1) An authorized Chelton Flight Systems dealer will remove each IDU from its rack.
(2) The flash card access cover located on top of the IDU will be removed to access the flash card.
(3) Press the extraction button to eject the flash card from the IDU.
(4) The flash card will either be replaced with another flash card with an updated data base, or the mechanic will install the flash card in a suitable computer and copy the data from a CD-ROM supplied by Chelton Flight Systems.
(5) After updating the flash card, the card is removed from the computer and installed in the IDU.
(6) The cover access cover is replaced on the IDU and the IDU is installed in the rack.
(7) Insert a SmartMedia card in the IDU and apply power.
(8) Select the “Terrain Data Verification” option to verify the terrain database card.

NOTE: *Terrain database verification can take up to 30 minutes. Do not remove power from IDU during database operation.*

DOWNLOAD LOG FILES

Selecting the "Download LOG Files" option on the IDU will create a "\log" directory on the data card and copy the data logging files into the "\log" directory of the data card. The data logging files contain recordings of flight and engine parameters of up to 5 hours each from the previous 5 operations of the system. During system operation, flight and engine parameters are recorded every 1 second. Each time the parameters are recorded, a Zulu time stamp followed by 3 lines of comma delimited ASCII text data are written where the first line contains flight parameters, the second line contains engine #1 parameters and the third line contains engine #2 parameters.

NOTE: *Engine parameters will contain no information in certified installations at this time.*

The following table shows the exact data format:

First Line (Flight)	Second Line (Engine #1)	Third Line (Engine #2)
Latitude (°)	RPM[1]	RPM[1]
Longitude (°)	Fuel Flow (GPH)	Fuel Flow (GPH)
MSL Altitude (ft)	Aux. 1[2]	Aux. 1[2]
Pitch Angle (°)	Left Fuel (Gal.)	--
Bank Angle (°)	Right Fuel (Gal.)	--
Heading (° Mag.)	Fuel Pressure (PSI)	Fuel Pressure (PSI)
Track (° Mag.)	Aux. 5[3]	Aux. 5[3]
IAS (kts)	Oil Temperature (°F)	Oil Temperature (°F)
TAS (kts)	Oil Pressure (PSI)	Oil Pressure (PSI)
Ground Speed (kts)	Volts	Volts
VSI (fpm)	EGT #1 (°F)[4]	EGT #1 (°F)[4]
Glidepath (°)	CHT #1 (°F)[5]	CHT #1 (°F)[5]
G-force	EGT #2 (°F)[6]	EGT #2 (°F)[6]
Wind Speed (kts)	CHT #2 (°F)	CHT #2 (°F)
Wind Direction (° Mag.)	EGT #3 (°F)	EGT #3 (°F)
OAT (°F)	CHT #3 (°F)	CHT #3 (°F)
Density Altitude (ft)	EGT #4 (°F)	EGT #4 (°F)
Fuel Totalizer Qty. (Gal.)	CHT #4 (°F)	CHT #4 (°F)
--	EGT #5 (°F)	EGT #5 (°F)
--	CHT #5 (°F)	CHT #5 (°F)
--	EGT #6 (°F)	EGT #6 (°F)
--	CHT #6 (°F)	CHT #6 (°F)
--	Aux. Temp. 1 (°F)[7]	Aux. Temp. #1 (°F)[7]
--	Aux. Temp. 2 (°F)[8]	Aux. Temp. #2 (°F)[8]
--	Induction Temperature (°F)	Induction Temperature (°F)

[1]N1 (%) on turbine engine installations.
[2]Manifold pressure (in.Hg) on piston engine installations.
[3]Water temperature (°F) on liquid cooled engine installations. Fuel Pressure #2 on turbine engine installations.
[4]TIT1 or ITT (°F) on turbine engine installations.
[5]N2 on turbine engine installations.
[6]TIT2 (°F) on turbine engine installations.
[7]TIT1 (°F) on piston engine installations.
[8]TIT2 (°F) on piston engine installations. Torque (%) on turbine engine installations.

FUEL TANK CALIBRATION

Selecting “Fuel Tank Calibration” option will begin the fuel tank calibration program for non-certified installations. Selecting this option on a certified system will cause the IDU to return to the Ground Maintenance menu.

VIEW FUEL TANK CALIBRATION MAP

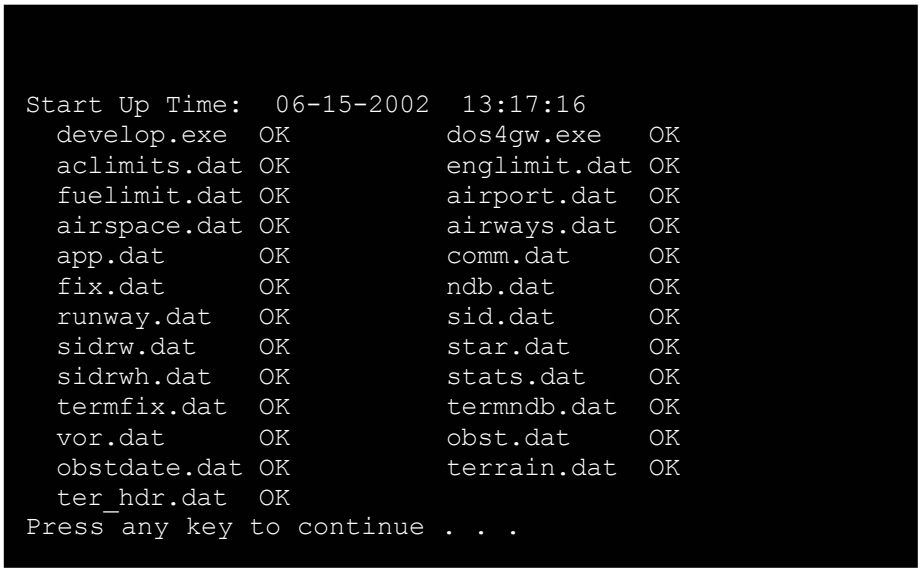
Selecting “View Fuel Tank Calibration Map” option allows the user to view and edit the fuel tank calibration map for non-certified installations. Selecting this option on a certified system will cause the IDU to return to the Ground Maintenance menu.

VIEW BITLOG.DAT

Selecting "View bitlog.dat" option allows the user to view the "bitlog.dat" file generated on each system startup. During startup, the system performs a CRC-32 calculation on each vital file and compares the result to stored CRC-32 values. Any disagreement between CRC-32 values means that a file has been corrupted and the system is unreliable. The system will not start when this condition exists.

Should the system fail to start due to a bad CRC-32 check, this option can be used to view the "bitlog.dat" file so that the corrupted file can be identified. Contact Chelton Flight Systems technical support with the identity of the corrupt file so that an update file to cure the corruption can be sent.

After selecting this option the following screen appears:



Any corrupted file will be identified by the word "FAIL" next to the file name. Press any key to return to the Ground and Maintenance Functions menu.

NOTE: *If a file is corrupted, loading the appropriate Software Update, Navigation Database, or Obstruction Database will correct the failure. If the terrain flags (terrain and ter_hdr) are corrupted, perform a terrain data verification by selecting the "Terrain Data Verification" option from the GMF menu to clear the fault or determine the failure.*

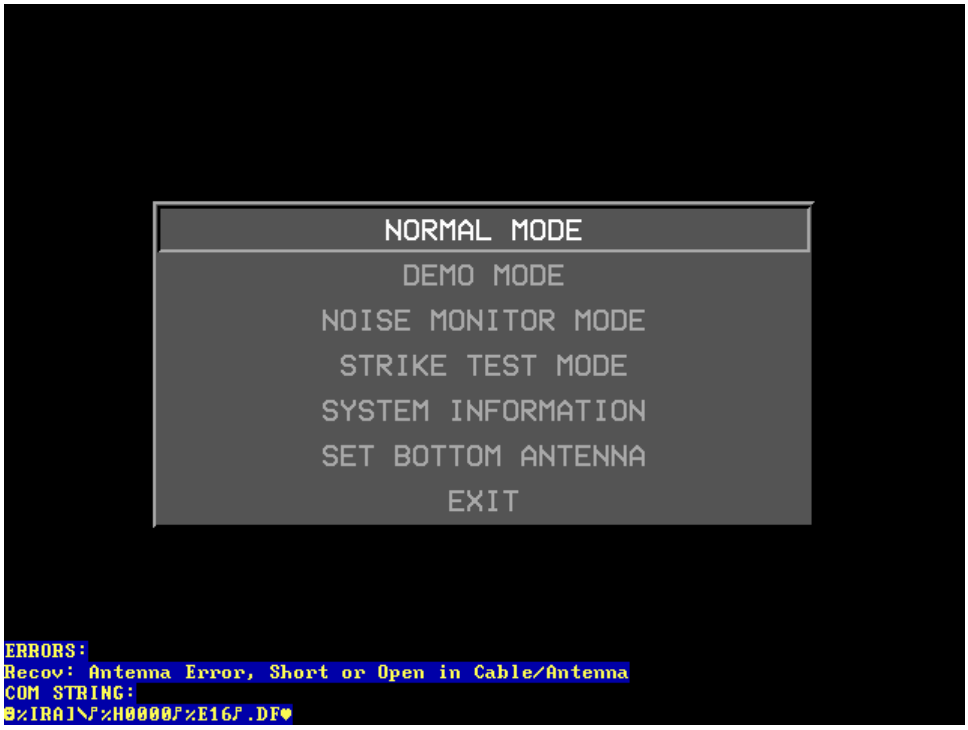
L3 WX-500 MAINTENANCE UTILITY

Selecting "L3 WX-500 Maintenance Utility" option starts the maintenance utility for the L3 WX-500 passive lightning sensor on an IDU with an SCC#0 or SCC#1 in the tray. Before running the WX-500 maintenance utility, ensure the following:

1. The WX-500 equipment is installed as recommended by the manufacturer.
2. The WX-500 is properly connected to the IDU as specified in the WX-500 Installation Instructions.
3. A Software Configuration Card with the WX-500 option enabled is installed in the IDU tray. If this is not done, the warning message "Make sure that you are using IDU#1 and that the aircraft limits configuration specifies that a WX-500 is installed" will appear and the WX-500 maintenance utility will not start.
4. Only run the WX-500 maintenance utility from IDU #1. If this is not done, the warning message "Make sure that you are using IDU#1 and that the aircraft limits configuration specifies that the WX-500 is installed" will appear and the WX-500 maintenance utility will not start.

The following describes the various pages of the WX-500 maintenance utility:

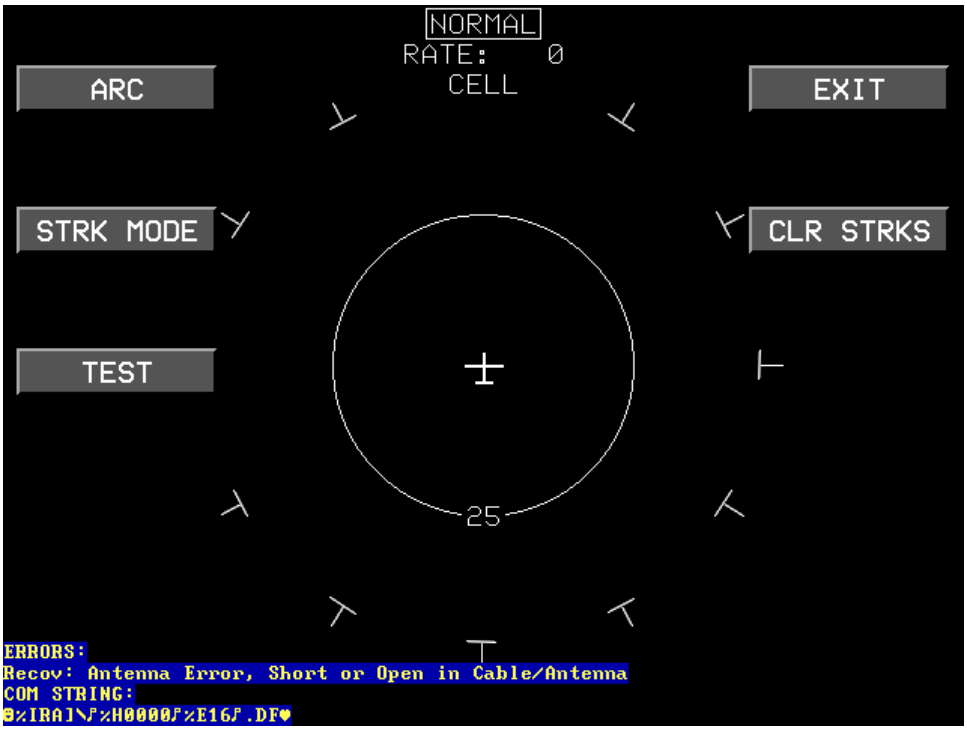
Main Page:



This page allows the user to select the various options needed for installation and maintenance of the WX-500. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. An option box appears in the center of the page for selecting the other pages (Normal Mode, Demo Mode, Noise Monitor Mode, Strike Test Mode, and System Information), for setting the WX-500 software antenna setting, and for exiting the WX-500 maintenance utility.

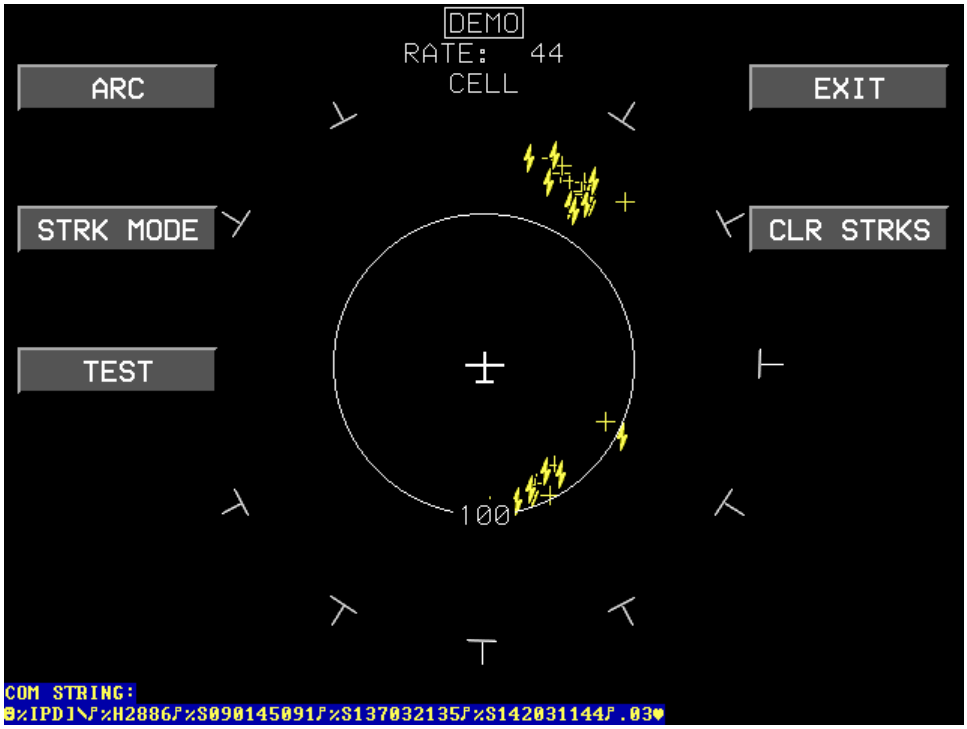
The software antenna setting option is used to clear an "Antenna jumper changed from last operation" error message. The WX-500 maintenance utility receives antenna jumper position from the WX-500 and automatically selects the proper software antenna setting (top or bottom) for transmission to the WX-500. However, transmission of the software antenna setting to the WX-500 does not occur until the "SET [TOP/BOTTOM] ANTENNA" option tile is selected with the lower right rotary encoder. Thus, the jumper error message will not be cleared until the software antenna setting option is physically activated by the user. This allows the user a chance to verify that the antenna jumpers are properly positioned prior to clearing the jumper error.

Normal Mode:



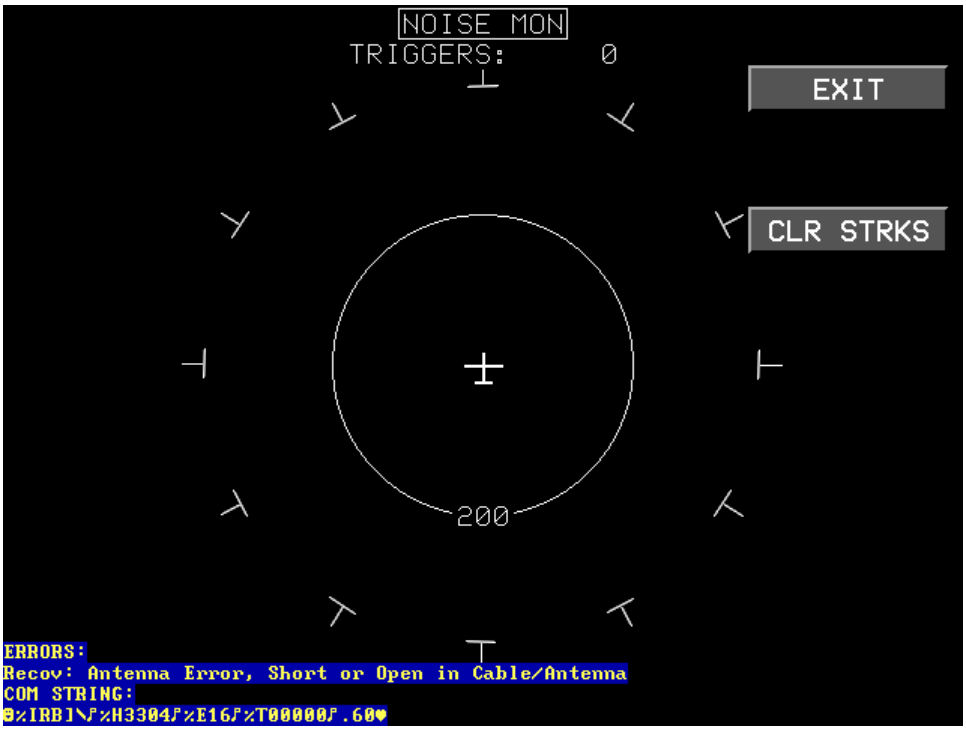
The normal mode puts the WX-500 into normal operation. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. Soft menu selections allow the user to select arced or centered (360° view) displays, select strike mode or cell mode, perform pilot-initiated tests, clear strikes, or exit to the main page. Display scale is changed by rotating the lower right rotary encoder. Detected strikes will appear within the display using the symbology described in the User's Manual. See WX-500 documentation for further explanation of WX-500 modes and options.

Demo Mode:



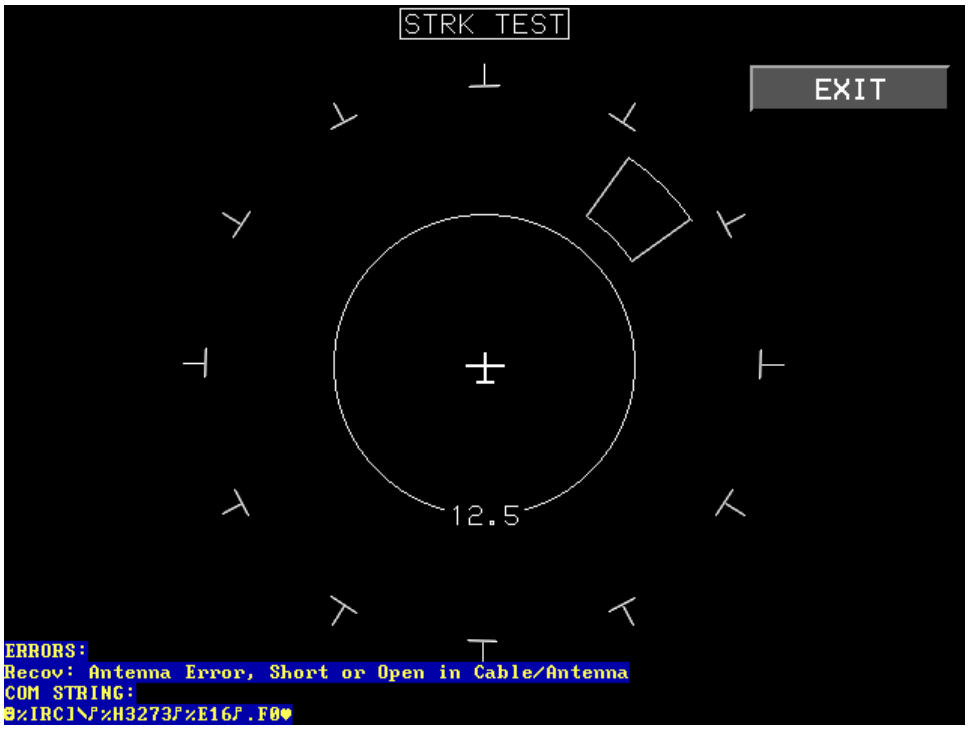
The demo mode puts the WX-500 into a demonstration mode of operation. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. Soft menu selections allow the user to select arced or centered (360° view) displays, select strike mode or cell mode, perform pilot-initiated tests, clear strikes, or exit to the main page. Display scale is changed by rotating the lower right rotary encoder. Simulated strikes will appear within the display using the symbology described in the User's Manual. See WX-500 documentation for further explanation of WX-500 modes and options.

Noise Monitor Mode:



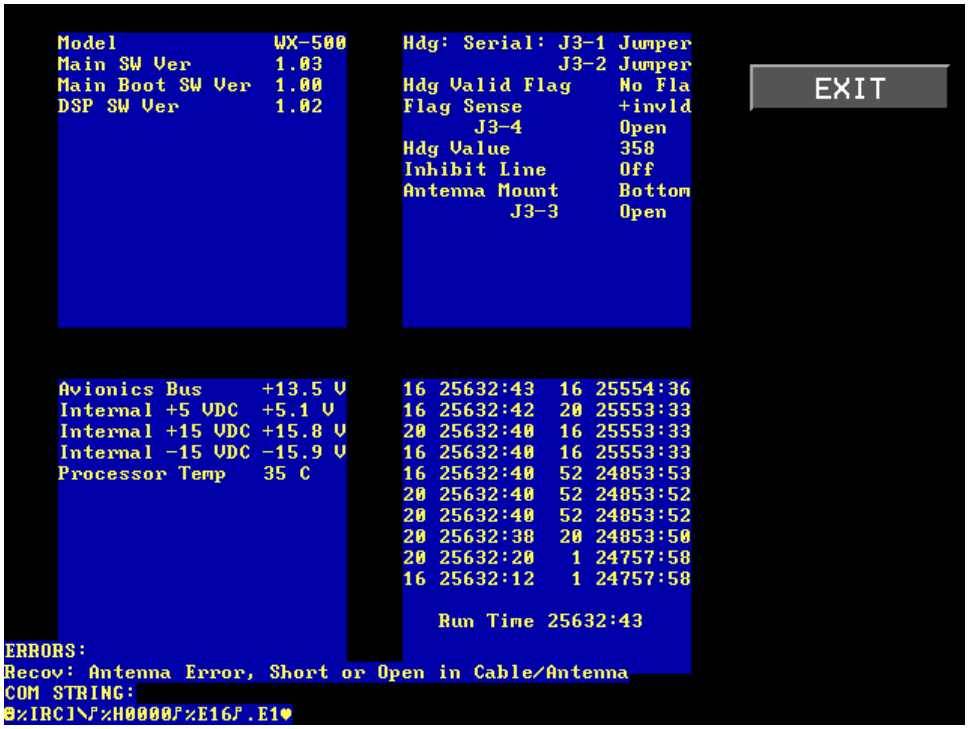
The noise monitor mode puts the WX-500 into noise monitor mode of operation. This mode shows a special high-sensitivity 400NM scale and is used to select a noise-free antenna mounting location. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. Soft menu selections allow the user to clear strikes, or exit to the main page. Display scale cannot be changed in this mode. Detected noise will increment the trigger count and appear as strikes using the symbology described in the User's Manual. See WX-500 documentation for further explanation of the noise monitor mode.

Strike Test Mode:



The strike test mode puts the WX-500 into strike test mode of operation. This mode shows a special target box at the 1 to 2 o'clock position and is used to verify that test strikes are being properly processed and displayed. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. A soft menu selection allows the user to exit to the main page. Display scale is fixed at 25NM and cannot be changed in this mode. Test strikes using the symbology described in the User's Manual should appear within the confines of the target box. Test strikes disappear after one second and do not age in the normal manner. This allows the user to confirm continuous sensing of test strikes that are generated approximately every two seconds by the L3 testing equipment. See WX-500 documentation for further explanation of the strike test mode.

System Information Page:



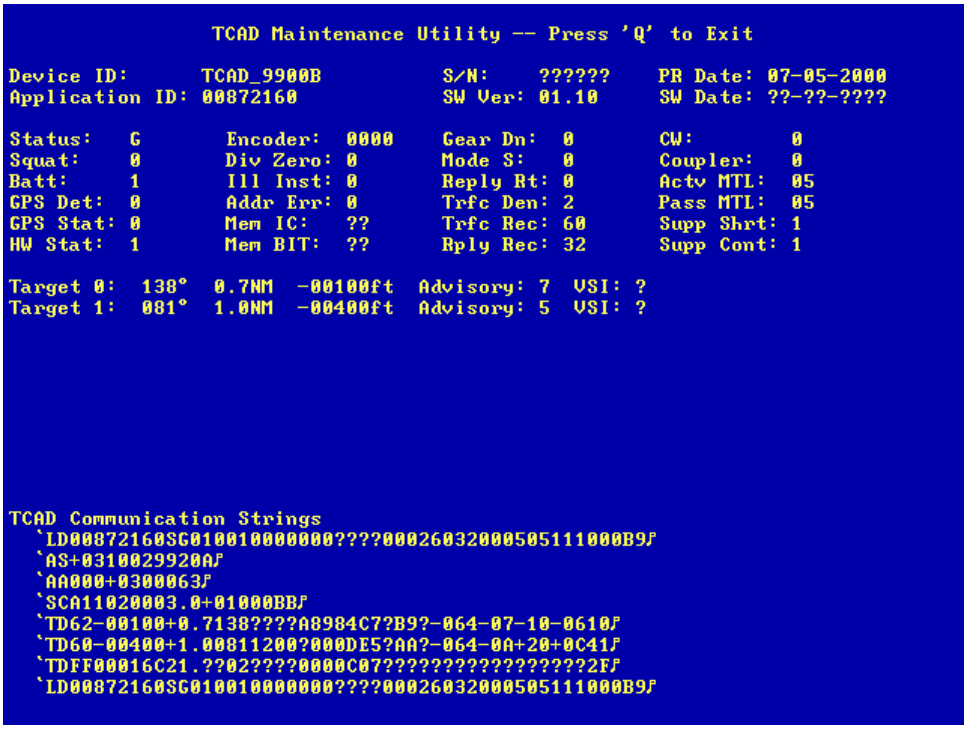
The system information page displays the four pages of system information transmitted by the WX-500. These pages are used for general troubleshooting of the WX-500. The last communication string received from the WX-500 and a listing of active errors appears in the lower left corner of the page. A soft menu selection allows the user to exit to the main page. See WX-500 documentation for further explanation of the system information page.

RYAN TCAD MAINTENANCE UTILITY

Selecting "Ryan TCAD Maintenance Utility" option starts the maintenance utility for the Ryan TCAD 9900B passive traffic advisory system and TCAD 9900BX active traffic advisory system on an IDU with a SCC#0 or SCC#1 in the tray. Before running the TCAD maintenance utility, ensure the following:

1. The TCAD equipment is installed as recommended by the manufacturer.
2. The TCAD is properly connected to the IDU as specified in the TCAD Installation Instructions.
3. A Software Configuration Card with the TCAD option enabled is installed in the IDU tray. If this is not done, the warning message "Make sure that you are using IDU#1 and that the aircraft limits configuration specifies that a TCAD is installed" will appear and the TCAD maintenance utility will not start.
4. Only run the TCAD maintenance utility from IDU #1. If this is not done, the warning message "Make sure that you are using IDU#1 and that the aircraft limits configuration specifies that a TCAD is installed" will appear and the TCAD maintenance utility will not start.

The TCAD maintenance utility consists of a single page with three different areas as shown below:



The top third of the TCAD maintenance utility page displays system parameters transmitted by the TCAD. Refer to documentation from Ryan International for details.

The middle third of the TCAD maintenance utility page displays current targets being transmitted by the TCAD. Target parameters include bearing (in degrees relative to nose position), range in nautical miles, relative altitude in feet (negative = traffic below, positive = traffic above), advisory level (0 to 7 with higher numbers being more critical), and VSI (+ = climbing more than 500fpm, - = descending more than 500fpm, ? = VSI is less than 500fpm).

The bottom third of the TCAD maintenance utility page displays in real time the communication strings sent by the TCAD.

Press any key on the IDU to exit out of the option. After exiting, the IDU will reboot.

TERRAIN DATA VERIFICATION

Selecting "Terrain Data Verification" option will verify the terrain database on the IDU. The Terrain Data Verification option performs a CRC-32 test of all of the terrain data packets stored on the hard drive. This test is only performed on condition, when the terrain database has been updated, or if an error occurs during flight.

If a data packet passes test, then an "OK" will be displayed after the file shown on the screen. If a packet fails, then a "FAIL" will be displayed.

```
C:\data\terrain\N19W100.dat  OK
C:\data\terrain\N19W101.dat  OK
C:\data\terrain\N19W102.dat  OK
C:\data\terrain\N19W103.dat  OK
C:\data\terrain\N19W104.dat  OK
C:\data\terrain\N19W105.dat  OK
C:\data\terrain\N19W106.dat  OK
C:\data\terrain\N19W107.dat  OK
BIT check finished – All terrain files OK!
Press any key to continue . . .
```

If a failure does occur, the mechanic should re-load terrain data from a known good source, or contact Chelton Flight Systems technical support for a new terrain database card.

Pressing a key at the prompt will place the IDU back to the Ground and Maintenance Functions menu.

WARNING!
Do not remove power from IDU during terrain verification as the data may become corrupted. If this occurs, the terrain verification should be re-run to confirm there has been no corruption.

NOTE: *Terrain database verification may take up to 30 minutes to perform. Ensure a ground power unit is installed on the aircraft prior to starting this procedure.*

DISPLAY INTERNAL TEMPERATURE

Selecting “Display Internal Temperature” option will start a program that displays the internal temperature of the IDU. This information is used for performing the temperature survey as part of the cooling installation.

Pressing any key on the IDU will exit out of the option. After exiting, the IDU will reboot.

DOWNLOAD ROUTES AND USER WAYPOINTS

Selecting “Download Routes and User Waypoints” option will download all routes and user waypoints stored in the IDU to the SmartMedia card. This option is useful for fleet operations where multiple aircraft fly the same routes.

Routes are stored on the SmartMedia card as NAME1-NAME2.RTE where NAME1 is the 1 to 5 character designation of the origin waypoint and NAME2 is the 1 to 5 character designation of the destination waypoint. User waypoints are stored on the SmartMedia card as USER.DAT.

UPLOAD ROUTES AND USER WAYPOINTS

Selecting “Upload Routes and User Waypoints” option will copy all routes and user waypoints stored on a SmartMedia card to the IDU. This option used in conjunction with the “Download Routes and User Waypoints” option enables the operator to store the same routes and user waypoints in multiple aircraft.

VIEW SYSTEM LIMITS

Selecting "View System Limits" option allows the operator or mechanic to view the current aircraft limits programmed into the EFIS. This option can only be viewed on an IDU with a SCC#0 or SCC#1 installed in the tray.

The System Limits are displayed in five pages. Pressing any button on the IDU or rotating the right hand encoder will advance to the next page. Modification of the limits is described in the section "IDU LIMITS PROGRAMMING".

System Speed Settings:

This page displays the EFIS airspeed settings and marks that can be modified by a mechanic with the IDU Limits program.

System Speed Settings:

Airspeed Scale Type:		FAR 23.1545
Airspeed Units:		Knots
Vso	= 68	
Vs	= 70	
Vmc	= 78	
Vx	= 80	Airspeed Scale Markings:
Vy	= 105	Low Speed Awareness (Red Arc) 0 to 68
Vyse	= 100	Flap Operating Range (White Arc) 68 to 130
Va	= 145	Normal Operating Range (Green Arc) 70 to 170
Vfe	= 130	Caution Range (Yellow Arc) 170 to 205
Vmfe	= 40	High Speed Awareness (Red Arc) 205
Vno	= 170	Red Line at 78
Vne/Vmo	= 205	Blue Line at 100
Mmo	= NA	Green Dot at 90
Climb Speed	= 110	White Triangle at 40
Climb Mach	= NA	
Glide Speed	= 90	
Procedure Speed	= 120	

Press Any Key to Continue

System Factory Programmed Settings:

This page displays the factory preset settings for the EFIS. To modify one of these settings, the SCC#0 or SCC#1 will need to be returned to the factory.

System Factory Programmed Settings:

Datalink	= Not Defined at this Time
TAWS Type	= Class C
Traffic Sensor	= Ryan TCAD (RS-232)
WX-500	= Installed

Press Any Key to Continue

System User Programmed Settings (Page 1):

This page displays the EFIS settings that can be modified by a mechanic with the IDU Limits program.

System User Programmed Settings (Page 1):

Autopilot Analog Gain	= 128
Autopilot Digital Gain	= 1
Autopilot Valid Polarity	= Open Collector is Valid
Autopilot Pitch Offset	= 0.00 degrees
Flight Director Enabled	= Disabled
Optional ARINC429 Output	= OFF
VOR Symbology Enabled	= Enabled
Remote Tuning Enabled	= Disabled
Mach Display Enabled	= Disabled
PLI Display Enabled	= Disabled
Stall Warning Enabled	= Disabled
Slip-Skid Display Enabled	= Disabled

Press Any Key to Continue

System User Programmed Settings (Page 2):

This page displays additional EFIS settings that can be modified by a mechanic with the IDU Limits program.

System User Programmed Settings (Page 2):

Altimeter Set Units	= in. Hg
Temperature Units	= Degrees F
Remote Control Panel	= Not Defined at this Time
Analog Interface Unit	= Installed
Weather Radar Intrfc	= Not Defined at this Time
Landing Gear Config	= Retractable
CPU Number	= 1
Glide Ratio	= 14
GPS Antenna Offset	= 12.00 feet
Temperature Recovery	= 0.68
Flight Path Quickening	= 1000
Audio Warning Volume	= 4 out of 15
A429 Com21 RX Speed	= Low
A429 Com22 RX Speed	= Low
A429 Com23 RX Speed	= Low
A429 Com24 RX Speed	= Low
A429 Com25 RX Speed	= Low
A429 Com26 RX Speed	= Low
A429 Com27 RX Speed	= Low
A429 Com28 RX Speed	= Low

Press Any Key to Continue

System Fuel Totalizer Settings:

This page displays the fuel settings for the EFIS. These settings can be modified by a mechanic with the IDU Limits program.

System Fuel Totalizer Settings:

Volume Units	= Lbs. (Jet Fuel)
Fuel Totalizer Enabled	= Enabled
Max Fuel Quantity	= 18500
Main Fuel Quantity	= 5000
Low Fuel Caution	= 300
Low Fuel Alarm	= 100
Fuel Quantity Sensor	= Not Installed
Totalizer Qty Warn	= Disabled
Fuel Tank Split Warn	= Disabled

Press Any Key to Continue

System Engine Settings:

This page displays the engine limits settings if programmed. This page is for experimental aircraft only.

System Engine Settings (No Engine Monitoring):

Press Any Key to Continue

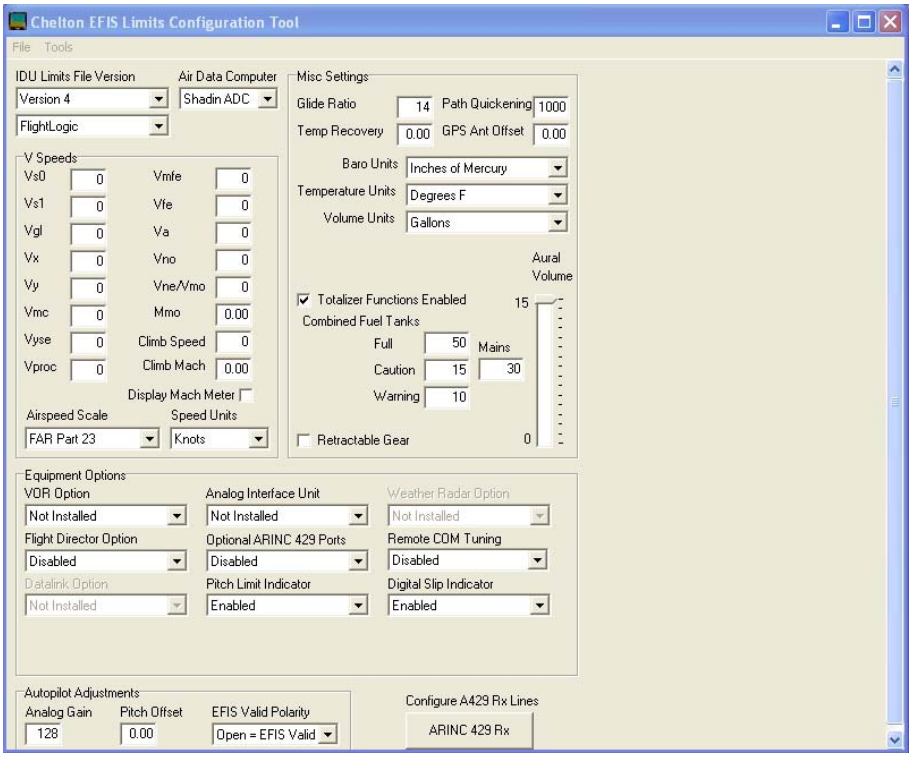
IDU LIMITS PROGRAMMING

The IDU Limits software is installed on a computer running Windows® 95 or greater and has access to a SmartMedia card reader/writer. The software allows user modification of aircraft operational parameters on the EFIS for each aircraft.

WARNING!
Failure to program the EFIS for aircraft specific limits prior to first flight may cause unsafe flight conditions. Consult with the operator of the aircraft during programming of all limits.

The modified limits are saved to a file on the computer named "*limits.txt*". This file is copied to a SmartMedia card in the root directory (*x*:\), then installed in the PFD for updating the EFIS from the Ground Maintenance menu "Update" option.

The limits are stored on the PFD System Configuration Card (SCC #1), or for single IDU system (SCC #0). Once the data has been stored on the SCC, the data is transferred to all of the IDUs upon the next power on cycle.



The IDU Limits software is installed by running the setup program bundled with the software package. Default installation will place the "IDU Limits.exe" program in the directory C:\Program Files\Chelton \IDU_Limits and will set the associated menu to "IDU Limits".

The menu bar consists of two tabs. These are:

Files

OPEN – Opens an existing "limits.txt" file on the computer or associated drives.

SAVE – Saves to the file "limits.txt".

PRINT SCREEN – Prints the IDU Limits window to the computers default printer.

EXIT – Exits the IDU Limits program.

NOTE: *Print out the limits.txt file or use the PRINT SCREEN option and place a copy in the aircraft log book for future reference.*

Tools

TEMPERATURE RECOVERY FACTOR CALCULATOR TOOL – Calculates the outside air temperature recovery factor from altitude, air speed, and OAT data collected during test flights. Temperature recovery is described later in this section.

The programmable limits are displayed as pull-down pick list items or user entry boxes. These limits are grouped into five sections which include: software version, V speeds, equipment options, miscellaneous settings, and engine page.

NOTE: *Engine page is only available in the experimental EFIS. Accessing or altering the settings in the engine page section will not effect the EFIS in the certified version.*

IDU Limits File Version

The IDU limits file version is determined by the software revision on the IDU.

Limits File Version 1 is for EFIS software revision 4.0F and earlier.

Limits File Version 2 is for EFIS software revision 4.0H and 4.0J.

Limits File Version 3 is for EFIS software revision 4.1A.

Limits File Version 4 is for EFIS software revision 5.0A and higher.

WARNING!
Ensure the limits file version corresponds to the software revision on the IDU. Selecting the wrong limits file version will cause the EFIS to error on initialization.

IDU Software Version
The IDU software version for the certified EFIS system is "FLIGHTLOGIC".

Air Data Computer
This option selects the type of air data computer that is interfaced with the EFIS. The options are:

ARINC 429 – Uses an existing ADC with ARINC-429 capability
Chelton EAU – Uses the CFS Engine and Air data Unit (experimental only)
Chelton ADC – Uses the CFS Air Data Unit (Not available at this time)
Shadin ADC – Uses the Shadin ADC-2000 for Chelton interface
Chelton EAU + Shadin ADC – Uses the CFS Engine and Air data Unit and Shadin ADC-2000 (experimental only)

V Speeds (Aircraft)
The V Speeds are defined below:

Vso - The aircraft's stalling speed (in knots) at gross weight with gear and flaps extended. This value defines the bottom of the "white arc" area of the IDU airspeed indicator scale and the top of the "red arc" low-speed awareness area of the IDU airspeed indicator scale. This value is mandatory.

Vs1 - The aircraft's stalling speed (in knots) at gross weight with gear and flaps retracted. If Vno is non-zero, then Vs defines the bottom of the "green arc" area of the IDU airspeed indicator scale. This value also defines the location of the "Vs" airspeed scale marker in 1-G flight, is used for calculating the pitch limit indicator symbology and for determining whether the aircraft is in ground or flight mode. This value is mandatory.

Vgl - The aircraft's best glide speed (in knots) at gross weight with gear and flaps retracted. This value defines the location of the "green dot" best glide speed marker on the airspeed scale and is used for calculating the glide range display. This value is mandatory.

Vx - The aircraft's best angle of climb speed (in knots) at gross weight with gear and flaps retracted. This value defines the location of the "Vx" airspeed scale marker. If this value is set to 0, the "Vx" airspeed scale marker is not shown.

Vy - The aircraft's best rate of climb speed (in knots) at gross weight with gear and flaps retracted. This value defines the location of the "Vy" airspeed scale marker. If this value is set to 0, the "Vy" airspeed scale marker is not shown.

Vmc - The aircraft's minimum control speed (in knots) with the critical engine inoperative. This value defines the location of the "Vmc" redline. If this value is set to 0, the "Vmc" redline is not shown.

Vyse - The aircraft's single engine best rate of climb speed (in knots) at gross weight with gear and flaps retracted. This value defines the location of the "Vyse" blue line. If this value is set to 0, the "Vyse" blue line is not shown.

Vfe - The aircraft's maximum flap extended speed (in knots). This value defines the top of the "white arc" area of the IDU airspeed indicator scale. This value is mandatory.

Vproc - The aircraft's normal speed (in knots) for flying instrument approaches (DPs, IAPs, and STARs). This value is used for calculating the turn radius used for instrument procedure legs. This value is mandatory.

Va - The aircraft's maneuvering speed (in knots) at gross weight. This value defines the location of the "Va" airspeed scale marker. If this value is set to 0, the "Va" airspeed scale marker is not shown.

Vno - The aircraft's maximum structural cruising speed (in knots) defined as the maximum speed for operation in turbulence. This value defines the top of the "green arc" and the bottom of the "yellow arc" areas of the IDU airspeed indicator scale. If

this value is set to 0, then the "green arc" and "yellow arc" areas are not shown.

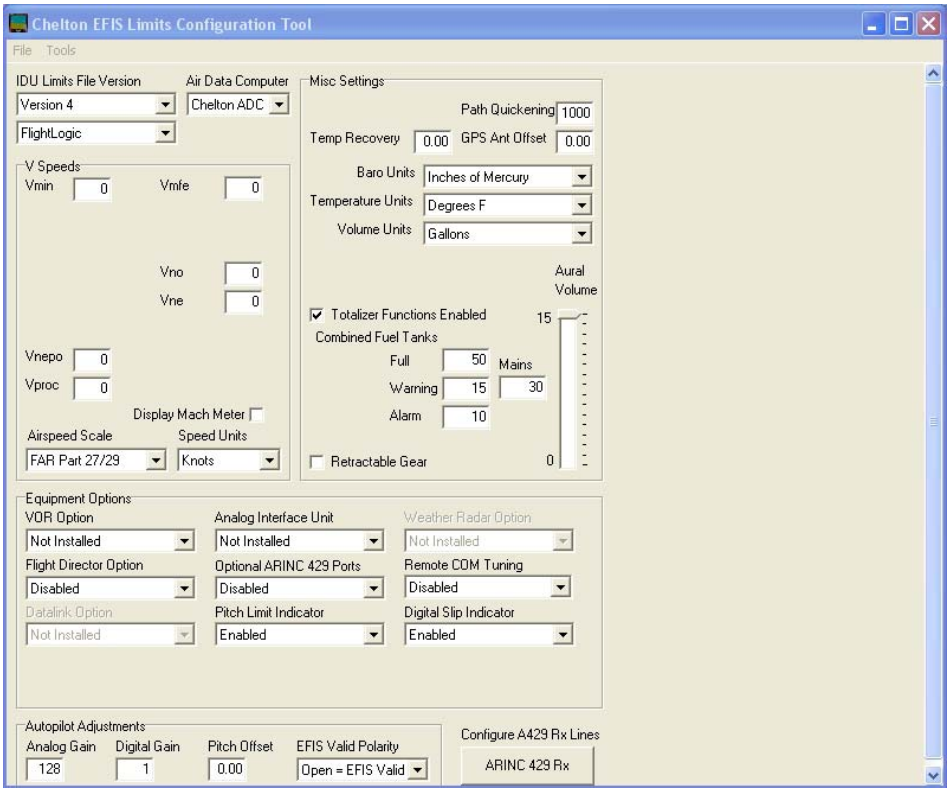
Vne/mo - The aircraft's never exceed speed (in knots). Vmo is the aircraft's maximum operating limit speed (in knots). Either this value or the airspeed equivalent of Mmo, whichever is lower, defines the bottom of the high-speed "red arc" area of the IDU airspeed indicator scale. In addition, if a Vno value exists, then this value is assumed to be Vne and defines the top of the "yellow arc" area of the IDU airspeed indicator scale. This value is mandatory.

Mmo - The aircraft's maximum operating Mach number. This value is converted to airspeed by the IDU depending upon the value of outside air temperature and pressure. Either this value or Vmo, whichever is lower, defines the bottom of the high-speed "red arc" area of the IDU airspeed indicator scale. Vmo typically controls at low altitude while Mmo typically controls at high altitude. If this value is set to 0, then Vne/Vmo value is assumed to be Vne and Mmo is not used.

Climb Speed - The aircraft's preferred cruise-climb speed (in knots). Either this value or the airspeed equivalent of climb Mach, whichever is lower, defines the speed for determining the maximum autopilot pitch steering target. This value is mandatory.

Climb Mach - The aircraft's preferred climb Mach number. If climb Mach is non-zero, then climb Mach is converted to airspeed by the IDU depending upon the value of outside air temperature and pressure. Autopilot pitch steering during climb uses the lower of climb speed or converted climb Mach as the speed for determining the maximum pitch steering target. Climb speed typically controls at low altitude while climb Mach typically controls at high altitude. If this value is set to 0, then climb Mach is not used.

Display Mach Meter – Displays the Mach meter on the PFD when selected.



V Speeds (Rotorcraft)

The V Speeds are defined below:

Vmin - The rotorcrafts minimum operating speed (in knots). This value defines the top of the red cross-hatched line (Vne (power off)) on the airspeed indicator scale. This value is mandatory.

Vnepo – The rotorcrafts minimum safe operating speed (in knots). This value defines the bottom of the “green arc” safe operating range area. This value is mandatory.

Vproc - The aircraft's normal speed (in knots) for flying instrument approaches (DPs, IAPs, and STARs). This value is used for calculating the turn radius used for instrument procedure legs. This value is mandatory.

Vno - The rotorcrafts maximum safe operating range (in knots). This value defines the top of the “green arc” safe operating range area and the bottom of the “yellow arc” caution range. This value is mandatory.

Vne - The aircraft's never exceed speed (in knots). This value defines the bottom of the high-speed "red arc" area of the IDU airspeed indicator scale. This value is mandatory.

Airspeed Scale
The Airspeed Scale dropdown control allows the airspeed scale markings to be set to the appropriate certification category. This provides the ability to adapt the airspeed indicator to the specific certification part that the aircraft as follows:

FAR Part 23 – small aircraft
FAR Part 25 – large aircraft
FAR Part 27/29 – rotorcraft

Airspeed Units
The Airspeed Units box selects the unit value of the V-Speeds defined above (limits version 3 and above). The unit selection is as follows:

Knots (default)
MPH (Miles per Hour)

Equipment Options
The equipment options are defined as follows:

VOR Option - Used to determine if an external VOR is connected to the EFIS. This selection will allow the display of VHF navigation symbology on the PFD and MFD pages from either an ARINC-429 Nav receiver interface or from the Analog Interface Unit.

Analog Interface Unit - Used to indicate that an Analog Interface Unit has been installed in the aircraft. The Analog Interface Units is used to convert analog navigation signals to digital for the IDUs, and to convert digital autopilot commands to analog signals for interfacing with analog autopilots.

Flight Director Option – Used to determine if an external flight director is connected to the EFIS. This selection will allow display of an autopilot flight director command bars on the PFD from either an ARINC-429 flight director interface or from the Analog Interface Unit.

Weather Radar Option – Used to determine if an external weather Radar receiver is connected to the EFIS. This selection will allow display of weather Radar information on the EFIS. This option is not available at this time.

TAWS System Type – Used to determine the type of TAWS to be displayed on the EFIS. The selections are:

TAWS Class A RG + F – fixed wing Class A TAWS with retractable gear and flap position switch
TAWS Class A RG – fixed wing Class A TAWS with retractable gear
TAWS Class A FG + F - fixed wing Class A TAWS with fixed gear and flap position switch
TAWS Class A FG – fixed wing Class A TAWS with fixed gear
TAWS Class B – fixed wing Class B TAWS
TAWS Class C – fixed wing Class C TAWS
HTAWS Class A RG – helicopter Class A TAWS with retractable landing gear
HTAWS Class A FG – helicopter Class A TAWS with fixed landing gear
HTAWS Class B – helicopter Class B TAWS

NOTE: Selection of TAWS System Type is programmed when ordered and is not adjustable in the field.

WX-500 Option – Used to determine if a WX-500 Stormscope® computer is connected to the EFIS. This selection will allow display of the WX-500 weather data on the MFD.
NOTE: Selection of WX-500 Option is programmed when ordered and is not adjustable in the field.

Datalink Option – Used to determine if a WSI Datalink receiver is connected to the EFIS. This selection will allow display of the WSI Datalink receiver on the EFIS. This option is not available at this time.

Traffic Sensor Option – Used to determine if an external traffic sensor is connected to the EFIS. This selection will allow display of a TAS or TCAS-1 traffic sensor on the PFD and MFD. The options are:

Not Installed – no traffic sensor is connected
Ryan TCAD – Ryan 9900B(X) computer
Goodrich Flight Watch – L-3 (Goodrich) Skywatch®, Skywatch® HP, or ARINC-429 TAS computer

NOTE: Selection of the Traffic Sensor Option is programmed when ordered and is not adjustable in the field.

Remote Control Panel Option – Used to determine if external remote control panels for the EFIS are connected. This selection will allow operation of remote controlling for specific functions of the EFIS. This option is not available at this time.

Optional ARINC 429 Ports – Used to enable the EFIS the ability to emulate a Bendix/King EFIS40/50 system to drive a KFC-325 autopilot via Com23 (low speed) or Com24 (high speed) from the PFD.

Pitch Limit Indicator – Used to enable the Pitch Limit Indicator on the PFD.

Remote Com Tuning – Used to enable the EFIS the ability to tune a remote Nav/Com radio from Com9. Radios that can be remote tuned from this option are the Bendix/King KX-155A/165A or Garmin SL-30.

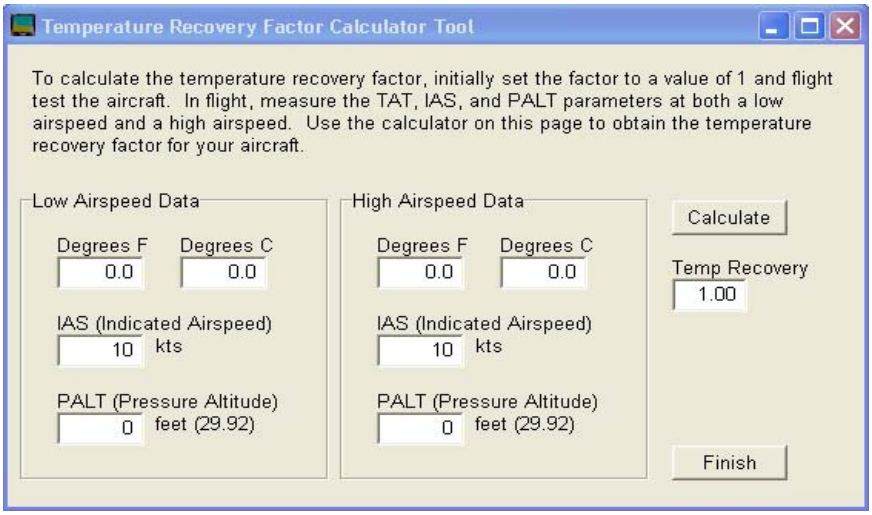
Misc Settings

Under Misc Settings, there are a number of general limitations that are set for the operation of the aircraft. These are:

Glide Ratio - This is the aircraft's engine-out glide ratio (forward distance traveled / altitude loss). The IDU uses this value to compute glide range on the ND. Set to "0" to turn this function off.

Temp Recovery - This is the aircraft's temperature recovery factor. This factor is used to compensate for OAT sensing errors caused by compressibility of the air at the aircraft's OAT probe mounting location. This value is calculated by selecting the **Tools** menu and performing a test flight.

WARNING!
The Temp Recovery must be set to 0.00 prior to performing any test flight that will collect data for the Temperature Recovery Factor Calculator Tool. A Temp Recovery of 0.00 will allow the EFIS to display the raw data from the ADC.



- The airspeeds to be flown will be the lowest safe airspeed without stalling and the highest safe airspeed without exceeding the limits of the aircraft.

- Test altitudes should be within 100 feet between low and high airspeeds.

- Only Centigrade or Fahrenheit need be recorded. The software will automatically convert the unchanged value.

- Proper values for Temperature Recovery will be between +5.00 and -4.00. The best location for the temperature sensor will have a value close to 0.00. Normal recovery factors are near +0.65

- After all collected values are inserted, press the *Calculate* button to perform the calculation

- When completed, press the *Finish* button to store the data in the correct location and exit the calculator tool. The window will disappear and the *Temp Recovery* value will be replaced with the value just calculated.

Path Quickening - The IDU uses this value to factor G-force into barometric vertical speed to derive an instantaneous vertical speed. Instantaneous vertical speed is used along with ground speed to calculate the aircraft's climb or descent angle relative to the earth. Climb or descent angle is used to determine the position of the PFD flight path marker symbol. The greater this value, the more sensitive the instantaneous vertical speed calculation is to G-force.

The initial setting of the Path Quickening should be approximately equal to:

WING LOADING x 100

A flight test should be performed to determine the operation of the Flight Path Marker using one of the following methods:

1. Perform a 45° angle of bank and observe whether the aircraft Glidepath is easily held using only the Flight Path Marker.
2. Hand-fly an ILS approach and observe whether the Glidepath is easily held using only the Flight Path Marker.

If the Flight Path Marker is smooth and does not exhibit any indicated lag, then the Path Quickening value is correct.

GPS Antenna Offset - This value contains the GPS antenna vertical offset in feet.

Baro Units - This dropdown control selects the units of barometric pressure. Choices are inches of Mercury and millibars/hectoPascals.

Temperature Units - This dropdown control selects the units of temperature displayed on the IDU. Choices are degrees Fahrenheit and degrees Celsius.

Volume Units - This dropdown control selects the volume units used for displaying fuel quantity and flow on the IDU. Choices are:
Gallons
Liters
Pounds Gasoline
Pounds Jet Fuel
Kilograms Gasoline
Kilograms Jet Fuel

Totalizer Function Enabled – This box is checked (default) to allow the fuel totalizer function on the EFIS (limits version 3 and above). Deselect this box to disable the fuel totalizer functions when fuel flow transducers are not available for a particular installation.

Fuel Low Alarm Level - This value determines the aircraft fuel quantity at which a low fuel alarm is issued. A low fuel alarm

consists of a red "LOW FUEL" annunciation flag, and a repeating (until manually silenced) "FUEL LOW" voice annunciation. Units of measure are determined by the Volume Units selection.

Fuel Warning Level - This value determines the aircraft fuel quantity at which a low fuel warning is issued. A low fuel warning consists of a yellow "LOW FUEL" annunciation flag, and a single "FUEL LOW" voice annunciation. Units of measure are determined by the Volume Units selection.

Fuel Tank Full Level - This value is the total useable fuel quantity and is used for fuel totalizer functions. Units of measure are determined by the Volume Units selection.

Mains - This value is the total useable fuel quantity when filled to the tabs and is used for quick setting of the fuel level after refueling to the tabs (limits version 2). Units of measure are determined by the Volume Units selection.

Retractable Gear - Indicates that the aircraft is equipped with retractable landing gear when checked.

Aural Volume – Adjusts the volume level of the EFIS aural annunciations and tones (limits version 2 and above).

Autopilot Adjustment

This group of adjustments allows fine tuning of autopilot roll and pitch operations (limits version 3 and above) by adjusting error signals to the existing autopilot.

NOTE: *Most autopilot tuning adjustments are performed during AIU installation. Ensure that the AIU adjustments are proper prior to adjusting the analog gain. The AIU has no effect on the ARINC-429 roll steering output and has no bearing on the digital gain setting.*

Analog Gain – Adjusts the analog heading gain to the autopilot to correctly track skyway turns. The value of the box divided by 128 defines the gain sent to the autopilot as follows:

- If a heading error signal from the EFIS of 20° results in 20° of bank, then the *Autopilot Gain* value should be 128.

- If a heading error signal from the EFIS of 20° results in 30° of bank, then the *Autopilot Gain* value should be 85.

- If a heading error signal from the EFIS of 20° results in 15° of bank, then the *Autopilot Gain* value should be 170.

$$\text{VALUE} = \frac{2560}{\text{BANK ANGLE}}$$

Default value is 128.

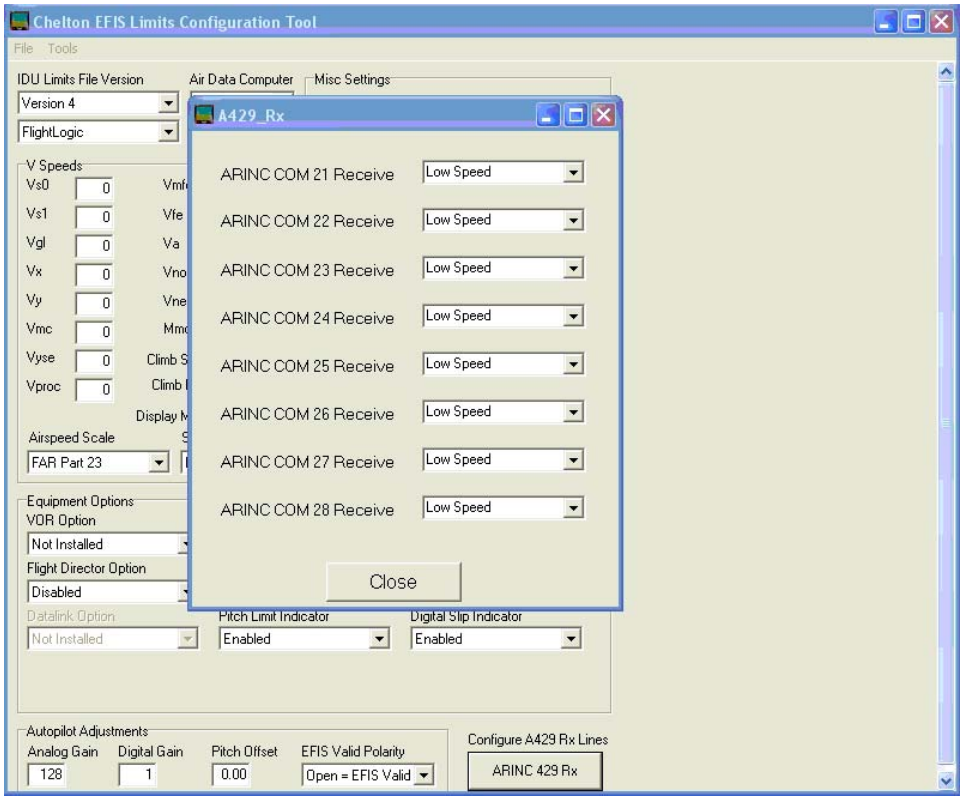
Digital Gain – Applies a gain to the digital roll steering output (ARINC-429). Tuned by adjusting the value and observing autopilot performance relative to tracking the heading bug. Increase the value if heading capture is too slow/undershoots. Decrease the value if heading capture is too fast/overshoots. Default value is 1.

Pitch Offset – Difference in pitch reference between flight director and EFIS. If there is a difference between the pitch reference for the flight director computer and the EFIS, this value introduces an offset to NULL the difference. Default value is 0.00.

EFIS Valid Polarity – Selects either an Active High or Active Low output to be sent to an autopilot.

ARINC-429 RX – Selects either ARINC-429 high speed or ARINC-429 low speed for COM21 thru COM28 inputs.

Default value is low speed for all receiver ports.


Chelton EFIS Limits Configuration Tool
File Tools
IDU Limits File Version
Version 4
FlightLogic
Air Data Computer
Misc Settings
V Speeds
Vs0 0
Vs1 0
Vgl 0
Vx 0
Vy 0
Vmc 0
Vyse 0
Vproc 0
Airspeed Scale
FAR Part 23
Equipment Options
VOR Option
Not Installed
Flight Director Option
Disabled
Datalink Option
Not Installed
Pitch Limit Indicator
Enabled
Digital Slip Indicator
Enabled
Autopilot Adjustments
Analog Gain 128
Digital Gain 1
Pitch Offset 0.00
EFIS Valid Polarity
Open = EFIS Valid
Configure A429 Rx Lines
ARINC 429 Rx
A429_Rx
ARINC COM 21 Receive Low Speed
ARINC COM 22 Receive Low Speed
ARINC COM 23 Receive Low Speed
ARINC COM 24 Receive Low Speed
ARINC COM 25 Receive Low Speed
ARINC COM 26 Receive Low Speed
ARINC COM 27 Receive Low Speed
ARINC COM 28 Receive Low Speed
Close

DATABASE UPDATES

UPDATE REQUIREMENTS

This section describes the procedures required to update the software and/or databases in the IDU. When an update is performed, the procedures will be performed on every IDU in the EFIS system separately. Scheduled updates are:

Navigation Database	Every 28 days
Obstruction Database	Every 56 days

Unscheduled or on-condition updates are:

EFIS Software
Terrain Database

EFIS SOFTWARE UPDATES

EFIS system software update procedures are covered by Service Bulletin.

NAVIGATION DATABASE UPDATE

The Jeppesen navigation database is updated every 28 days. The database can be obtained from Chelton Flight Systems either at their web site or by mail. There are three types of navigation databases that can be used on the EFIS. These are:

Americas – Contains North, Central and South America
World – Contains major airports and navigation aids around the world
International – Contains the world database without the Americas

The database is loaded on each IDU by placing the program **navdata.exe** on a SmartMedia card. Perform the same steps as the EFIS software update described above.

OBSTRUCTION DATABASE UPDATE

The obstruction database is updated every 56 days. The availability of the obstruction database is determined by a government agency in each country. Not all countries have obstruction databases available.

The obstruction database can be obtained from Chelton Flight Systems at their web site or by mail. The database is loaded on each

IDU by placing the program **obst.exe** on a SmartMedia card and follow the instructions outlined in the EFIS software update described above.

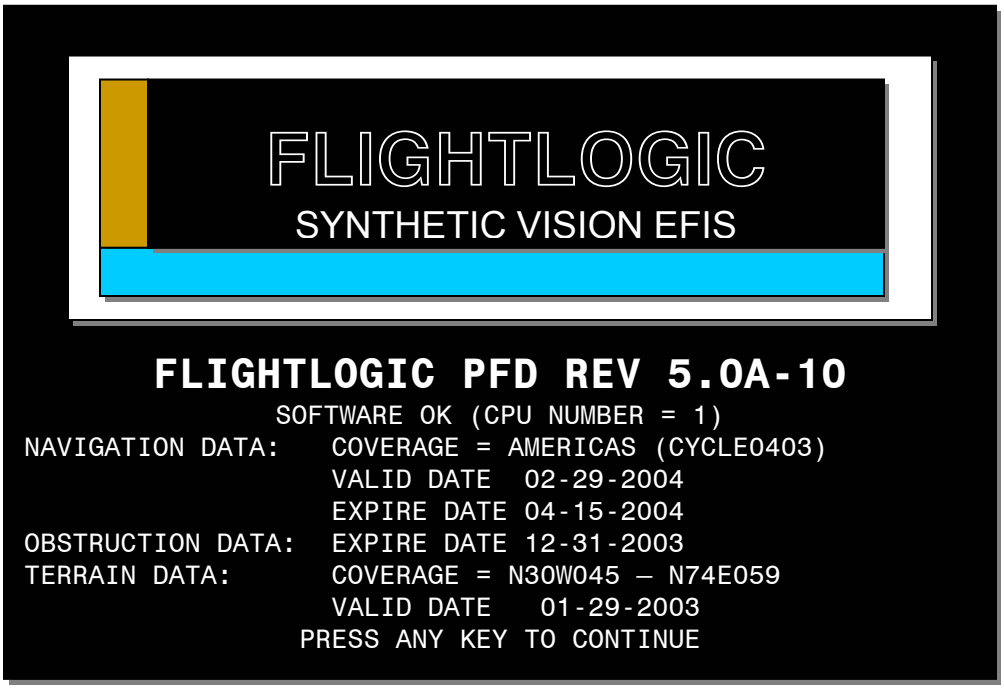
TERRAIN DATABASE UPDATE

The terrain database is updated on an as-needed basis. The database is stored on an ATA type III PCMCIA card that can be accessed from the top of the IDU when removed from the rack. Due to the size of the database, the terrain cannot be updated through a SmartMedia card. When the terrain database requires updating, the following procedure is performed:

(1) Obtain an updated terrain database on an ATA card from Chelton Flight Systems.
(2) Remove the IDU from the rack.
(3) Remove the drive access cover located on top of the IDU.
(4) Press the eject button until the card extends above the IDU housing.
(5) Remove the old ATA card and insert the updated terrain database card in the same slot.
(6) Press the card in until the card is fully seated.
(7) Replace the drive access cover.
(8) Install the IDU in the rack.
(9) Insert a SmartMedia card in the IDU and select the "Terrain Data Verification" option from the Ground Maintenance menu to validate the new terrain.
(10) Upon completion, remove power then SmartMedia card from IDU.
(11) Apply power and verify that the new terrain database has been accepted by noting the terrain coordinates and the "SOFTWARE OK" message on the IDU at the system status screen.
(12) Repeat steps 1 thru 9 for each additional IDU in the aircraft.

DATABASE VERIFICATION

Verification of the current EFIS software, Navigation Database coverage and expiration, Obstruction Database expiration, and Terrain Database coverage are displayed on each IDU upon completion of the self-test after applying power to the unit. This display is called the Status Page. The operator or mechanic must acknowledge that the information on the Status Page has been accepted by pressing a button or rotating the right hand encoder on each IDU.



Typical Status Page

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Chapter 6

Ground Functional Test

		PASS	FAIL
1.0	**PURPOSE OF TEST:**		
1.1	The procedures defined in this plan will demonstrate the proper operation of the EFIS System as installed on _____ aircraft.		
2.0	**TEST EQUIPMENT REQUIRED:**		
2.1	Pitot/Static Tester DMM Pilot's Guide and Reference		
3.0	**STRUCTURAL TESTS AND DOCUMENTATION**		
3.1	Structural test of ADC mounting shelf per Chapter 2, Task 9.	_____	_____
3.2	Structural test of GPS mounting shelf per Chapter 2, Task 14.	_____	_____
3.3	Structural test of AHRS mounting shelf per Chapter 2, Task 17.	_____	_____
3.4	Ensure locations for all equipment installed per this STC are documented in the appropriate Instructions for Continued Airworthiness.	_____	_____
4.0	**EFIS SYSTEM WIRING TEST:**		
4.1	Do not connect any equipment connectors until the following steps have been completed, prior to applying power to any system component.	_____	_____
4.2	Verify the wiring. Each wire should be continuity checked as indicated on drawing 702-045250 W/D EFIS IDU Interface, 702-045251 W/D Aircraft Interface, and Chapter 4.	_____	_____
4.3	All shield wire, shielded twisted pairs and shielded twisted triple cable should be checked for shorts to the shield.	_____	_____
4.4	Apply aircraft 14 or 28 Volt DC power (as applicable). Place the EFIS Master Switch or Avionics Master to ON.		

					PASS	FAIL
	Verify that the proper voltage is on the proper pin only, in each connector and is controlled by the assigned circuit breaker.					
	No.1 PFD	Connector	9515-J1	Pins-D14, D15, E14, E15	_____	_____
	No.1 MFD	Connector	9525-J1	Pins-D14, D15, E14, E15	_____	_____
	ADC No. 1	Connector	P9511-2	Pin-55	_____	_____
	GPS No. 1	Connector	P9512-1	Pin-6	_____	_____
	AHRS No. 1	Connector	P9513-1	Pin-3	_____	_____
	Optional Equipment					
	No.2 MFD	Connector	9535-J1	Pins-D14, D15, E14, E15	_____	_____
	No.3 MFD	Connector	9545-J1	Pins-D14, D15, E14, E15	_____	_____
	ADC No. 2	Connector	P9521-1	Pin-55	_____	_____
	GPS No. 2	Connector	P9522-1	Pin-6	_____	_____
	AHRS No. 2	Connector	P9523-1	Pin-3	_____	_____
4.5	Place the EFIS Master switch or Avionics Master to OFF and remove aircraft 14 or 28V DC power.				_____	_____
4.6	At this time install all IDUs and connect all source equipment connectors to their respective components. Push all related circuit breakers in.				_____	_____

5.0 POWER UP EFIS SYSTEM TEST:

NOTE: Not all switches and circuit breakers specified below are installed in all aircraft configurations. Activate the switches and circuit breakers applicable. Steps not required should be marked N/A.

NOTE: The IDUs must be configured for applicable aircraft type prior to beginning the following test using the IDU Limits program described in Chapter 4.

NOTE: GPS may take up to 30 minutes to acquire current satellite constellation upon initial operation. Ensure aircraft is in a location that will allow acquisition of GPS and WAAS satellites.

5.1	Place the EFIS Master Switch or Avionics Master to the ON position as required.	_____	_____

		PASS	FAIL
	NOTE: EFIS system will perform a self-test routine (approximately 45 seconds) and then display the status page. After pressing a button on the IDU, the EFIS may take up to 2 minutes to complete initialization. During this time, a count down timer will be displayed on all IDUs. Upon completion of the initialization, if any component signals are not being received, amber warning flags will display on the PFD, and the voice warning system will inform you which component signals are missing.		
	NOTE: The ADC requires up to 90 seconds from application of power before it is fully operational. The warm-up time will increase if unit temperature is colder than 75ºF (20ºC). The ADC will transmit data after 6 seconds, but will not clear the initialization bit until the ADC is fully operational. During this time, the EFIS will display an "ADC INIT" flag on all IDUs.		
5.2	Pull the #1 ADC circuit breaker and verify that the "NO AIR DATA" amber caution flag is visible on the PFD, with a single auditory annunciation "AIR DATA FAILURE – AIR DATA FAILURE".	_____	_____
5.3	Reset the #1 ADC circuit breaker and verify that the "NO AIR DATA" flag is removed within 90 seconds.	_____	_____
5.4	If installed, select the #2 ADC then pull the #2 ADC circuit breaker. Verify that the "NO AIR DATA" amber caution flag is visible on the PFD, with a single auditory annunciation "AIR DATA FAILURE – AIR DATA FAILURE".	_____	_____
5.5	Reset the #2 ADC circuit breaker and verify that the "NO AIR DATA" flag is removed within 90 seconds.	_____	_____
5.6	Pull the #1 GPS circuit breaker and verify that the "GPS LON" amber caution flag is visible on the PFD, with a single auditory annunciation "GPS FAILURE – GPS FAILURE."	_____	_____
5.7	Reset the #1 GPS circuit breaker and verify that the "GPS LON" flag is removed within 2 minutes.	_____	_____
5.8	If installed, select the #2 GPS then pull the #2 GPS circuit breaker. Verify that the "GPS LON" amber caution flag is visible on the PFD, with a single auditory annunciation. "GPS FAILURE. GPS FAILURE"	_____	____
5.9	Reset the #2 GPS circuit breaker and verify the "GPS LON" flag is removed within 2 minutes.	_____	_____

		PASS	FAIL
5.10	Pull the #1 AHRS circuit breaker and verify that the "NO ATTITUDE" amber caution flag is visible on the PFD, with a single auditory annunciation. "ATTITUDE FAILURE – ATTITUDE FAILURE."	_____	_____
5.11	Reset the #1 AHRS circuit breaker and verify the "NO ATTITUDE" flag is removed within 90 seconds.	_____	_____
5.12	If installed, select the #2 AHRS then pull the #2 AHRS circuit breaker. Verify that the "NO ATTITUDE" amber caution flag is visible on the PFD, with a single auditory annunciation. "ATTITUDE FAILURE – ATTITUDE FAILURE".	_____	____
5.13	Reset the #2 AHRS circuit breaker and verify the "NO ATTITUDE" flag is removed within 90 seconds.	_____	_____
5.14	If installed, pull the TCAD circuit breaker. Verify that the "AUX SENSOR" flag is visible on the PFD, with a single auditory annunciation "AUXILLARY SENSOR FAILURE, AUXILLARY SENSOR FAILURE". Select the FAULTS menu on the MFD and verify that an "X" is shown after TCAD.	_____	_____
5.15	Reset the TCAD circuit breaker and verify the "AUX SENSOR" flag is removed and the "X" changes to "OK" within 10 seconds.	_____	_____
5.16	If installed, pull the WX-500 circuit breaker. Verify that the "AUX SENSOR" flag is visible on the PFD, with a single auditory annunciation "AUXILLARY SENSOR FAILURE, AUXILLARY SENSOR FAILURE". Select the FAULTS menu on the MFD and verify that an "X" is shown after WX-500.	_____	_____
5.17	Reset the WX-500 circuit breaker and verify the "AUX SENSOR" flag is removed and the "X" changes to "OK" within 20 seconds.	_____	_____
5.18	If installed, pull the AIU circuit breaker. Verify that the "AUX SENSOR" flag is visible on the PFD, with a single auditory annunciation "AUXILLARY SENSOR FILURE, AUXILLARY SENSOR FAILURE". Select the FAULTS menu on the MFD and verify that an "X" is shown after AIU.	_____	_____
5.19	Reset the AIU circuit breaker and verify the "AUX SENSOR" flag is removed and the "X" changes to "OK" within 20 seconds.	_____	_____

6.0 AIR DATA TEST

6.1 IDU Indications and Warning

NOTE: If dual ADC systems are installed, perform the following test on both pitot/static systems.

	PASS	FAIL

6.1.1 Connect the pitot/static tester to the aircraft pitot and static system in accordance with the aircraft manufacturer's maintenance manual. _____ _____

6.1.2 Select a barometric setting of 29.92 for the altimeter setting on the PFD, using the right-hand control knob on the bezel. _____ _____

6.2 System Leak Test

6.2.1 Test ADC 1 and ADC 2 (if installed) static system leak per the aircraft maintenance manual or by performing the following test:
Set the Pitot/Static test set to a static altitude of 1000 feet above field elevation and monitor the static leak. Without additional pumping for a period of 1 minute, the loss of indicated altitude must not exceed 100 feet on the EFIS for unpressurized aircraft. _____ _____

6.2.2 Test ADC1 and ADC2 (if installed) pitot system leak per aircraft maintenance manual. _____ _____

6.3 System Verification Test

6.3.1 Test the ADC 1 and ADC 2 (if installed) altitude displayed on the EFIS by performing the following test:
Set the Pitot/Static test set to the test points below and verify the EFIS altitude meets the tolerance. Failure of any test point will require replacement of the ADC.

Altitude (feet)	Tolerance	Measured
0	±25	
1000	±25	
4000	±25	
11000	±35	
20000	±50	

_____ _____

6.3.2 Test the ADC 1 and ADC 2 (if installed) airspeed displayed on the EFSI by performing the following test:
Set the Pitot/Static test set to the test points below and verify the EFIS airspeed meets the tolerance. Failure of any test point will require replacement of the ADC.

Airspeed (MPH)	Tolerance (MPH)	Airspeed (Kts)	Tolerance (Kts)	Measured
57	±6	50	±5	
115	±2	100	±2	
173	±2	150	±2	
230	±2	200	±2	
288	±3	250	±2	

_____ _____

6.3 Fuel Flow Adjustment

		PASS	FAIL
6.3.1	Program the ADC with the K-Factor of the fuel flow transducer per Shadin ADC-2000 Installation Manual, Section 10.	_____	_____
6.4	OAT Probe Adjustment		
6.4.1	Ensure the OAT Calibration Code is properly selected per Shadin ADC-2000 Installation Manual, Section 9.	_____	_____
6.5	EMI Testing		
6.5.1	Monitor the EFIS while performing the following tests. If the "ADC FAIL" flag appears during a test, troubleshoot the offending device and repair as necessary.		
6.5.2	Transmit on all communication radios in the aircraft for 20 seconds at the lowest, highest, and mid-range frequencies (i.e., for a standard aircraft Com radio use 118.00MHz, 126.90MHz, and 136.95MHz). Verify the "ADC FAIL" flag is not present during or after each transmission. Secure radios after test.	_____	_____
6.5.3	Place all pulse type radios (ATC Transponder, DME, Weather Radar, etc.) in their normal mode of operation for 30 seconds and verify the "ADC FAIL" flag is not present during or after operation. Secure radios after test.	_____	_____
6.5.4	Operate all aircraft lighting (position lights, strobe lights, etc.) for at least 30 seconds and verify the "ADC FAIL" flag is not present during or after operation. Secure lighting after test.	_____	_____
6.5.5	Operate all aircraft environmental systems (if installed) for at least 30 seconds in each mode of operation and verify that the "ADC FAIL" flag is not present during or after operation. Secure environmental systems after test.	_____	_____
6.5.6	Operate the aircraft engine(s) for at least 30 seconds and verify that the "ADC FAIL" flag is not present during or after operation.	_____	_____
6.6	Fuel Flow Test		
6.6.1	While engine is operating for test 5.4.6, verify fuel flow is displaying correctly.	_____	_____
7.0	**CROSSBOW AHRS COMPASS ALIGNMENT**		
7.1	Perform a Compass alignment for the No. 1 AHRS in accordance with Crossbow Installation Manual P/N 7410-0001-02.	_____	_____

			PASS	FAIL
7.2	Move all control surfaces and cycle all aircraft systems including lighting, avionics, and environmental systems. Verify that the heading on the EFIS does not deviate more than 4° in either direction during these tests.			
7.2.1	Perform for the following headings:			
		360°	_____	_____
		90°	_____	_____
		180°	_____	_____
		270°	_____	_____
7.3	If Installed, Perform a Compass alignment for the No. 2 AHRS in accordance with Crossbow Installation Manual P/N 7410-0001-03 or later.		_____	_____
7.4	Move all control surfaces and cycle all aircraft systems including lighting, avionics, and environmental systems. Verify that the heading on the EFIS does not deviate more than 4° in either direction during these tests.		_____	_____
7.4.1	Perform for the following headings:			
		360°	_____	_____
		90°	_____	_____
		180°	_____	_____
		270°	_____	_____

8.0 LITEF AHRS COMPASS ALIGNMENT

8.1	Ensure the EFIS and AHRS have been operating for at least 60 seconds.	_____	_____
8.2	Set the Air/ground switch for the AHRS to “On Ground”.	_____	_____
8.3	Set the MSU Calibration Switch to “On”	_____	_____
8.4	Wait 2 minutes.	_____	_____
8.5	Turn to the next calibration position (45°).		
8.6	Wait 2 minutes.	_____	_____
8.7	Repeat steps 8.5 and 8.6 for all calibration positions (90°, 135°, 180°, 225°, 270°, and 315°).	_____	_____

	PASS	FAIL
8.8 Remove power from the AHRS and disable the MSU Calibration Switch.	_____	_____
8.9 Apply power to the AHRS and check for proper function.	_____	_____
9.0 No. 1 ATTITUDE TEST		
9.1 Apply power to the aircraft and place the EFIS master switch to the "ON" position. The No. 1 AHRS performs a self-test and initialization routing. This routine takes up to ninety seconds from the time the unit receives full electrical power, during which the aircraft must remain stationary		
9.2 Verify the attitude display and the aircraft deck angles agree in the roll & pitch axis of the aircraft.	_____	_____
10.0 No. 2 ATTITUDE TEST		
10.1 Apply power to the aircraft and place the EFIS master switch to the "ON" position. The No. 2 AHRS performs a self-test and initialization routing. This routine takes up to ninety seconds from the time the unit receives full electrical power, during which the aircraft must remain stationary		
10.2 Verify the attitude display and the aircraft deck angles agree in the roll & pitch axis of the aircraft.	_____	_____
10.3 Physically move the AHRS unit or rock the aircraft wings. Verify that heading and attitude changes on the IDU primary display.	_____	_____
11.0 No. 1 GPS TEST		
11.1 Verify GPS 1 circuit breaker is set and observe that the "GPS LON" amber warning flag does not appear on the No. 1 PFD and MFD.	_____	____

				PASS	FAIL
11.2	Press the *MENU* button on the right-hand side of the No. 1 MFD. Select *FAULTS* on the menu. Observe that the following are displayed:				
	GPS PWR	OK	GPS Receiver has power and is communicating with IDU	_____	_____
	GPS EQPMNT	OK	No equipment faults, antenna and coax cable are good	_____	_____
	GPS SATLT	OK	Good almanac and sufficient satellites to navigate in 3D	_____	_____
	GPS FDE	OK	Fault Detection and Exclusion algorithm operating	_____	_____
	GPS HLOI	OK	Horizontal integrity normal for phase of flight	_____	_____
	WAAS MSG	OK	WAAS message from satellites is usable	_____	_____
	WAAS HEALTH	OK	WAAS health message from satellites is good	_____	_____
	WX-500	OK	L3 WX-500 communication and status (only shown if optional WX-500 installed)	_____	_____
	TRFC	OK	Ryan 9900B(X) or L3 Skywatch communication and status (only shown if optional traffic sensor installed)	_____	_____
	AIU	OK	AIU communication and status (only shown if optional AIU installed)	_____	_____
				_____	_____
	NOTE: GPS and WAAS satellite status items will vary due to location of aircraft, time of day, and objects near the aircraft (buildings, hills, etc.).				
11.3	While monitoring the *FAULTS* menu on the MFD, evaluate the interference susceptibility between the GPS receiver and other avionic systems.				
11.3.1	Transmit each aircraft VHF COMM radio for 20 seconds on each of the following frequencies and verify that the "GPS LON" flag is not present on the PFD or MFD:				
	121.150, 121.175, 121.200, 131.250,131.275, 131.300 MHz.			_____	_____
11.3.2	Transmit each marine VHF (FM) radio on all programmed frequencies for 20 seconds and verify that the "GPS LON" flag is not present on the PFD or MFD:			_____	_____

		PASS	FAIL
11.3.3	Operate all "L" band (ATC Transmitter, DME, Satcom, TCAD/TCAS, etc.) and all High Frequency (ACARS, AFIS, Flighfone, etc.) equipment and verify that the "GPS LON" flag is not present on the PFD or MFD.	_____	_____
11.3.4	Operate all other aircraft systems and verify that the "GPS LON" flag is not present on the PFD or MFD.	_____	_____

12.0 No. 2 GPS TEST

12.1	If Installed, verify GPS 2 circuit breaker is set and observe that the "GPS LON" amber warning flag does not appear on the PFD and MFD when selected.			_____	____
12.2	Press the *MENU* button on the right-hand side of the No. 1 MFD. Select *FAULTS* on the menu. Observe that the following is displayed:				
	GPS PWR	OK	GPS Receiver has power and is communicating with IDU	_____	_____
	GPS EQPMNT	OK	No equipment faults, antenna and coax cable are good	_____	_____
	GPS SATLT	OK	Good almanac and sufficient satellites to navigate in 3D	_____	_____
	GPS FDE	OK	Fault Detection and Exclusion algorithm operating	_____	_____
	GPS HLOI	OK	Horizontal integrity normal for phase of flight	_____	_____
	WAAS MSG	OK	WAAS message from satellites is usable	_____	_____
	WAAS HEALTH	OK	WAAS health message from satellites is good	_____	_____
	WX-500	OK	L3 WX-500 communication and status (only shown if optional WX-500 installed)	_____	_____
	TRFC	OK	Ryan 9900B(X) or L3 Skywatch communication and status (only shown if optional traffic sensor installed)	_____	_____
	AIU	OK	AIU communication and status (only shown if optional AIU installed)	_____	_____
				_____	_____

NOTE: GPS and WAAS satellite status items will vary due to location of aircraft, time of day, and objects near the aircraft (buildings, hills, etc.).

		PASS	FAIL
12.3	While monitoring the *FAULTS* menu on the MFD, evaluate the interference susceptibility between the GPS receiver and other avionic systems.		
12.3.1	Transmit each aircraft VHF COMM radio for 20 seconds on each of the following frequencies and verify that the "GPS LON" flag is not present on the PFD or MFD:		
	121.150, 121.175, 121.200, 131.250, 131.275, 131.300 MHz.	_____	_____
12.3.2	Transmit each marine VHF (FM) radio on all programmed frequencies for 20 seconds and verify that the "GPS LON" flag is not present on the PFD or MFD.	_____	_____
12.3.3	Operate all "L" band (ATC Transmitter, DME, Satcom, TCAD/TCAS, etc.) and all High Frequency (ACARS, AFIS, Flighfone, etc.) equipment and verify that the "GPS LON" flag is not present on the PFD or MFD.	_____	_____
12.3.4	Operate all other aircraft systems and verify that the "GPS LON" flag is not present on the PFD or MFD.	_____	_____

13.0 EFIS LIMITS

13.1	Check all limits as programmed in the IDUs with the operator of the aircraft.		
13.1.1	Verify all V-Speeds and speed type is correct for the aircraft.	_____	_____
13.1.2	Verify all miscellaneous settings (units, fuel levels, glide ratio, aural volume, etc.) are programmed correctly.	_____	_____
13.1.3	Verify all options (TAWS class, traffic sensor, weather sensor, AIU, etc.) are programmed correctly.	_____	_____

14.0 RETURN AIRCRAFT TO SERVICE PER FAR 91.407(a).

Any "Fail" test items above shall be corrected and retested.

NOTE: Flight functional test required per FAR 91.470(b).

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Chapter 7

Flight Functional Test

1.0 GENERAL

1.1 REFERENCE DOCUMENTS

Note: The following documents should be readily available during testing.

DOCUMENT	VENDOR	DOCUMENT NUMBER
PILOT'S GUIDE	Chelton Flight Systems	150-045240
AFMS or RFMS	Chelton Flight Systems	150-045262 or 150-045709

2.0 PURPOSE

2.1 To conduct a functional flight test, to evaluate / verify proper operation and accuracy of the multi-sensor, Chelton EFIS System, including operational functions, transfer functions, switching functions, and electrical bus switching, pertaining to the EFIS installation.

	PASS	FAIL

3.0 FLIGHT TEST PROCEDURE

NOTE: An appropriately rated pilot for the type of aircraft must perform the following flight tests. No persons other than crew members may be on the aircraft during the flight test.

NOTE: Ensure the Temp Recovery factor for the EFIS limits is set to 0.00 prior to performing test flight or temperature values may be incorrect. See Chapter 5, IDU Limits Programming for details.

NOTE: All fight tests will be performed in day VFR conditions away from traffic as needed.

3.1 Evaluate all switching and transfer functions, including electrical bus switching pertaining to EFIS system. _____ _____

		PASS	FAIL
3.2	Verify continuity of navigation data during 360 degree left and right turns at 30 degrees of bank for each GPS installed on aircraft. The flag "GPS LON" shall not be displayed at any time during the test.	_____	_____
3.3	Conduct three approaches using the navigation database to verify proper operation of annunciations, waypoint sequencing, and display sensitivity changes, as appropriate, in accordance with TSO. This evaluation should include at least: turn anticipation, waypoint sequencing, display sensitivity changes, annunciations, procedure turns at the final approach fix (FAF), holding patterns at the missed approach holding fix, transitions from TO-FROM operation to TO-TO operation, heading legs after the initial approach fix (IAF) to intercept the final approach course both before and after the FAF, and DIRECT-TO operation before and after the IAF.	_____	_____
	NOTE: The following tests are performed to verify that the standby instruments provide the same information as displayed on the EFIS PFD within acceptable limits of the pilot. If the test is not acceptable, the installer must determine if the standby instrument or the EFIS is providing erroneous information and make corrective action as required.		
3.4	Verify that the altitude information on the EFIS is within 65 feet of the standby altimeter at an airspeed of 1.8 Vs and an altitude below 8000 feet MSL.	_____	_____
3.5	Verify the airspeed displayed on the EFIS is within 5 knots or 3% (which ever is greater) between 1.3 Vs and Vne/Vmo.	_____	_____
3.6	Pitch the aircraft up in 10 degree increments to a maximum of 20 degrees and verify that the attitude information on the PFD is within 3 degrees of the standby Attitude Indicator. Resume level flight after test.	_____	_____
3.7	Pitch the aircraft down in 10 degree increments to a maximum of 20 degrees and verify that the attitude information on the PFD is within 3 degrees of the standby Attitude Indicator. Resume level flight after test.	_____	_____

		PASS	FAIL
3.8	Roll the aircraft right in 10 degree increments to a maximum of 40 degrees and verify that the attitude information on the PFD is within 3 degrees of the standby Attitude Indicator. Resume level flight after test.	_____	_____
3.8	Roll the aircraft left in 10 degree increments to a maximum of 40 degrees and verify that the attitude information on the PFD is within 3 degrees of the standby Attitude Indicator. Resume level flight after test.	_____	_____
3.9	Fly a heading of 360, 90, 180, and 270 degrees and verify that the information on the EFIS is within 10 degrees of the standby directional gyro and/or wet compass.	_____	_____
	NOTE: If the wet compass is used as the standby heading source, the placarded limitations of the compass must be adhered (windscreen heat, radios, etc.).		
3.10	Verify V-Speeds are programmed properly on the EFIS PFD.	_____	_____
3.11	Verify all settings are programmed properly on the EFIS including:		
	Glide Ratio	_____	_____
	Fuel tank settings	_____	_____
	Equipment Options (AIU, VOR, Flight Director)	_____	_____
3.12	Verify the Flight Path Marker and Vertical Speed Indicator are operating properly on the PFD by performing one of the following tests:		
3.12.1	Hand-fly a 45° angle of bank and observe whether aircraft altitude and Glidepath are easily held using only the Flight Path Marker.	_____	_____
3.12.2	Hand-fly an ILS approach and observe whether aircraft Glidepath is easily held using only the Flight Path Marker.	_____	_____
3.13	If landing gear option is wired, cycle aircraft landing gear and verify the three landing gear lights are displayed under the Flight Path Marker on the PFD when the gear is down, and is removed when the gear is in transition or up.	_____	_____

		PASS	FAIL
3.14	If the fuel totalizer option is enabled, verify the fuel flow display is correct for the engine setting on the MFD.	_____	_____
3.15	If the Analog Interface Unit (AIU) is installed, verify all Nav and autopilot functions are operating properly per AIU Installation Manual, Chapter 5 (Doc. 570-7000).	_____	_____
3.16	If interfaced to an ARINC-429 Nav source, verify that the Nav information (VOR, LOC, GS) are properly displayed on the EFIS by selecting the Nav source as described in the Pilot's Operating Handbook.	_____	_____
3.17	If interfaced to an ARINC-429 Flight Director, verify that the flight director command bars (if installed) are properly displayed on the PFD when the Flight Director is activated. See the Pilot's Operating Handbook for details.	_____	_____
3.18	If interfaced to an ARINC-429 autopilot, program a flight plan on the EFIS and verify the autopilot keeps the aircraft within the HITS boxes as displayed on the PFD.	_____	_____
4.0	**EMI TESTING**		
	NOTE: For the following tests, a failed sensor will be displayed on the EFIS as: ADC Yellow "NO AIR DATA" flag AHRS Yellow "NO ATTITUDE" flag GPS Yellow "GPS LON" flag		
4.1	Transmit on the low, mid-range, and high frequencies of all COMM transmitters installed on the aircraft. Verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after each transmission.	_____	_____
4.1.1	Transmit each aircraft VHF COMM radio for 20 seconds on each of the following frequencies and verify that the "GPS LON" flag is not present on the PFD or MFD: 121.150, 121.175, 121.200, 131.250, 131.275, 131.300 MHz.	_____	_____
4.2	Place all pulse radios (ATC transponder, DME, weather Radar, etc.) in all modes of operation and verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after each mode of operation.	_____	_____

		PASS	FAIL
4.3	Operate all aircraft lighting (position, pulse, landing, etc.) and verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after operation.	_____	_____
4.4	Operate the aircraft environmental system (if installed) in all modes and verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after operation.	_____	_____
4.5	Cycle the aircraft landing gear (if retractable) and verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after operation.	_____	_____
4.6	Operate all other aircraft systems as installed in all modes and verify that there are no failures of the AHRS, ADC, or GPS sensors displayed on the EFIS during or after operation.	_____	_____

5.0 OAT COMPRESSIBILITY TEST

5.1 Maneuver the aircraft to a safe altitude away from other traffic. Hold the aircraft at a constant altitude and direction throughout the test.

5.2 Reduce airspeed as low as possible and maintain altitude without stalling the aircraft. Record the following:

OAT (°F) _____

IAS (KTS) _____

Altitude (FT) _____

5.3 Increase airspeed as high as possible while maintaining altitude without exceeding maximum airspeed. Record the following:

OAT (°F) _____

IAS (KTS) _____

Altitude (FT) _____

5.4 End of Flight Functional Test.

Document completion of Flight Functional Test in accordance with FAR 91.407(b) in the aircraft log books by the flight test pilot.

	PASS	FAIL

6.0 OAT PROGRAMMING

6.1 Run IDU Limits program on a computer with a SmartMedia card reader/writer attached.

6.2 Insert the values from steps 4.2 and 4.3 into Low and High value boxes.

6.3 Save the limits file to the SmartMedia card.

6.4 Insert the SmartMedia card in the PFD (No1 IDU).

6.5 Apply power to the IDU and verify Ground Maintenance menu is active.

6.6 Select item “B” to update the new value of the OAT compressibility factor.

6.7 Upon completion of the update, remove power from the IDU and remove the SmartMedia card.

Chapter 8

Troubleshooting

The following table provides additional information for the repairman to troubleshoot and repair the EFIS.

PROBLEM	CAUSE	SOLUTION
IDU does not power on (blank screen)	1. Loss of power	1a. Check IDU circuit breaker. Reset breaker. 1b. Verify power is on IDU P2 pins 5, 6, 7, and 8. Repair wiring. 1c. Verify unit is seated fully.
	2. Loss of ground	2. Verify ground continuity on IDU P2 pins 24, 25, 26, and 31. Repair wiring
IDU reboots continuously (will not finish self test)	1. Corrupted Navigation or Obstruction database	1. Check Navigation and Obstruction database validity by viewing the bitlog from the Ground Maintenance menu "View bitlog.dat" option (See Chapter 5). Reload faulty database.
	2. Corrupted software	2. Check software validity by viewing the bitlog from the Ground Maintenance menu "View bitlog.dat" option (See Chapter 5). Reload EFIS software.
	3. Corrupted Terrain database	3. Check Terrain database validity by viewing the bitlog from the Ground Maintenance menu "View bitlog.dat" option (See chapter 5). Perform Terrain verification from Ground Maintenance menu "Terrain Data Verification" option (See chapter 5). If Terrain is still corrupted, contact CFS Tech. Support for Ground drive replacement.
	4. SCC #0 or #1 not	4. Check limits validity by

PROBLEM	CAUSE	SOLUTION
IDU reboots continuously (will not finish self test) (Continue)	programmed with limits or defective SCC	viewing the bitlog from the Ground Maintenance menu "View bitlog.dat" option (See Chapter 5). Call CFS Tech. Support for replacement SCC if defective.
	5. SCC #1 limits version not supported by EFIS software	5. Correct limits version on SCC per applicable service bulletin for EFIS software in IDU.
IDU displays "No Operating System found" with a SmartMedia card installed, or IDU starts normal flight operations then reboots with SmartMedia card installed	1. Defective Ground Drive	1a. Ground drive card in IDU has become loose. Remove IDU from tray and press card into unit. 1b. Ground drive is defective. Swap with a known good ground drive and test IDU. If IDU operates normally, contact CFS Tech. Support for replacement drive.
No EFIS audio	1. Improper wiring	1a. Verify audio wiring from IDUs is connected to the un-muted audio input of the aircraft audio system. Repair wiring as required. 1b. Verify audio output is not shorted to the shield. Repair wiring as required. 1c. Verify audio slide bar on IDU Limits file is set to a value greater than 0.
	2. Defective IDU	2. Test IDU in PFD tray (SCC #1) with jumper cable between PFD and MFD disconnected. Replace IDU.
No EFIS audio muting	1. Improper wiring	1a. Verify wiring from IDUs are connected to the EFIS MUTE switch. Repair wiring. 1b. Verify wiring from the EFIS MUTE switch is connected to airframe ground.
	2. Defective MUTE switch	2. Test EFIS MUTE switch for proper operation. Replace switch if defective.
	3. EFIS displays a	3. EFIS audio muting is only

PROBLEM	CAUSE	SOLUTION
	caution flag	performed during a warning condition that is associated with a red flag on the IDU. The IDU will annunciate a caution condition twice per new occurrence.
No EFIS audio muting (continue)	4. EFIS will not mute	4. A sensor connected to the EFIS is cycling between valid and error. Troubleshoot sensors and repair or replace.
IDU always starts in Ground Maintenance menu	1. SmartMedia card installed in IDU	1. Verify a SmartMedia card or any object is not in the front slot of the IDU. Remove object and cycle power.
	2. Defective IDU	2. If IDU never boots into the flight mode, it may be defective. Replace IDU.
Cannot select items in Ground Maintenance menu	1. Improper wiring	1. Verify wiring from IDU to keyboard plug is correct. Repair wiring.
	2. IDU(s) turned off	2. Verify all IDUs are powered on. Keyboard will not function if one of the IDUs is off during Ground Maintenance functions.
EFIS system does not operate properly	1. SCC card(s) not installed correctly	1. Verify SCC cards are installed in the proper trays as follows: SCC #0 – MFD SCC #1 – PFD SCC #2 – MFD1 SCC #3 – MFD2 SCC #4 – MFD3 Locate cards as necessary.
	2. EFIS limits not correct	2. Program the limits by running IDU Limits program per Chapter 5.
IDU displays "NO ATTITUDE" flag	1. Defective wiring to AHRS	1a. Verify AHRS circuit breaker is in. Reset breaker. 1b. Verify power is present on AHRS pin 3. Repair wiring as necessary. 1c. Verify continuity between AHRS pin 4 and airframe ground. Repair wiring as

PROBLEM	CAUSE	SOLUTION
IDU displays "NO ATTITUDE" flag (Continue)		necessary. 1d. Verify communications wires from AHRS to IDU(s) is correct and not shorted to ground or each other. Repair wiring as necessary.
	2. AHRS not aligned	2. Verify AHRS alignment by running GYRO-VIEW with alignment cable connected to the AHRS and a laptop computer. Align AHRS if calibration flag is set.
	3. Defective AHRS	3. Replace AHRS.
IDU displays "NO AIR DATA" flag	1. Defective wiring to ADC	1a. Verify ADC circuit breaker is in. Reset breaker. 1b. Verify power is present on ADC pin 55. Repair wiring as necessary. 1c. Verify continuity between ADC pin 54 and airframe ground. Repair wiring as necessary. 1d. Verify communication wires from ADC to IDU(s) are correct and not shorted to each other or ground. Repair as necessary.
	2. Defective OAT probe	2a. Verify OAT probe wiring to ADC is correct. Repair wiring as necessary. 2b. Test OAT probe per Shadin OAT Install Manual. Replace probe as necessary. 2c. Test ADC by cycling the ADC circuit breaker while the EFIS is powered and operating. A defective OAT probe will allow the ADC to initialize by displaying a green "ADC INIT" flag on the IDU, then a yellow "NO AIR DATA" flag once initializing has been completed (within 90 seconds).
	3. Defective ADC	3. Inspect the status lights on the

PROBLEM	CAUSE	SOLUTION
		ADC for proper operation. Replace ADC if failed.
IDU displays "GPS LON" flag IDU displays "GPS LON" flag (Continue)	1. Defective wiring to GPS receiver	1a. Verify GPS circuit breaker is in. Reset breaker. 1b. Verify power is present on GPS pin 6. Repair wiring as necessary. 1c. Verify continuity between GPS receiver pin 19 and aircraft ground. Repair as necessary. 1d. Verify communication wires between GPS and IDU(s) is correct and not shorted to each other or ground. Repair as necessary.
	2. Defective equipment	2a. Verify GPS status by viewing the *FAULTS* menu on the MFD. i. If the menu shows an "X" after GPS PWR, then there is a loss of power or communications between the GPS and the IDU(s). Troubleshoot using item 1 above. ii. If the menu shows an "X" after GPS EQPMNT, then there is a fault in the receiver, antenna, or antenna coax. Repair or replace as necessary. iii. If the menu shows an "X" after GPS SATLT, then the GPS receiver is not receiving enough satellites to calculate a positional fix. Relocate aircraft to obtain better coverage or relocate the antenna if necessary. iv. If the menu shows an "X" after GPS FDE, GPS HLOI, WAAS MSG or, WAAS HEALTH, then

PROBLEM	CAUSE	SOLUTION
		satellites are being received, but positional errors are determined due to satellite coverage, position, etc. Consult NOTAMS for satellite availability.
IDU displays "AUX SENSOR" flag	1. Loss of WX-500 communications	1a. Verify WX-500 status by viewing the *FAULTS* menu on the MFD. If the menu shows an "X" after WX-500, then proceed to 1b and 1c. If the menu shows an "OK" after WX-500, then proceed to steps 2 or 3. 1b. Inspect comm. wiring from WX-500 to IDU(s) for shorts or opens. Repair as necessary. 1c. Verify WX-500 is operating normally per WX-500 Installation Manual.
	2. Loss of TCAD or Skywatch communications	2a. Verify status by viewing the *FAULTS* menu on the MFD. If the menu shows an "X" after TRFC, then proceed to 2b and 2c. If the menu shows an "OK" after TRFC, then proceed to steps 1 or 3. 2b. Inspect comm. wiring from traffic sensor to IDU(s) for shorts or opens. Repair as necessary. 2c. Verify traffic sensor is operating normally per sensor installation manual.
	3. Loss of AIU communications	3a. Verify AIU status by viewing the *FAULTS* menu on the MFD. If the menu shows an "X" after AIU, then proceed to 3b or 3c. If the menu shows an "OK" after AIU, then proceed to steps 1 or 2. 3b. Verify comm. wiring from AIU to IDU(s) for shorts or opens. Repair as necessary.

PROBLEM	CAUSE	SOLUTION
		3c. Verify AIU is operating normally per Chapter 9.

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Appendix A

Bell 206 and 407 Helicopter

The EFIS system can be installed on a Bell Model 206/407 helicopter for VFR operations. Appendix A describes the modification requirements for the airframe and instrument panel.

NOTE: *Prior to beginning any modifications, it is recommended that you read Appendix A entirely and study the figures as they relate to the described modifications.*

NOTE: *External backlighting of IDUs is not authorized for Bell 206/407 installation.*

INSTRUMENT PANEL MODIFICATION

The instrument panel must be modified as shown below. The PFD is mounted on top right-hand side of the panel with the MFD mounted directly below it. The engine indicators, in their original orientation, must be mounted adjacent to the tachometer and altimeter which must be mounted next to the IDUs as shown in figure A-1.

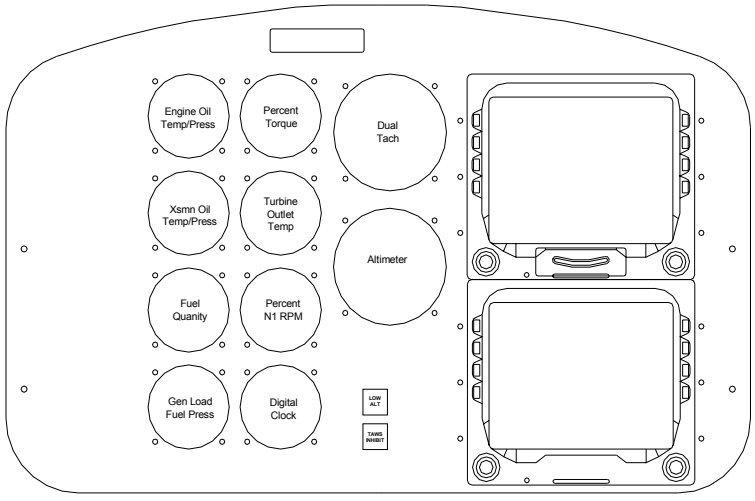

Figure A-1 PFD and MDF installation, helicopter (Bell 206/407)

The top of the instrument panel must be tilted 7° away from the pilot to increase readability of the MFD. This is accomplished according to the following procedure:

INSTRUMENT PANEL TILT PROCEDURE

NOTE: *Before beginning the described modification, please read the following instructions and study figure 2, "Panel Tilt Modification."*

1. Using a digital protractor, reference the angle of the original instrument panel.
2. Remove top cover and retain (10) for reinstallation.
3. Remove hardware (5) and mounting L brackets (1 & 2) and retain for reinstallation.
4. Remove rivets (7) and mounting bracket (6 & 8) from right and left side of instrument shroud.
5. Trim 1.5" from left and right support braces (3 & 4).
6. Loosely attach mounting brackets, (1, 2, 6 & 8) removed earlier, to new instrument panel.
7. Verify this modification results in a 7° difference in tilt of new panel. Adjust mounting holes as necessary to achieve proper tilt.
8. Fit new instrument panel into shroud so mounting brackets line up with support braces.
9. Back drill 4 new holes in support braces (3 & 4) using mounting L brackets as a template.
10. Temporally attach brackets to support brace.
11. Back drill rivet holes in left and right side of shroud using the support brackets (6 & 8) as a template.
12. Trim shroud and cover (10) to fit with instrument panel.
13. Locate and reinstall two nut plates (9) in shroud.
14. Using a hole finder, drill 2 new holes in top cover (10).
15. Back drill holes for attaching rivet on left and right side mounting brackets.
16. Attach left and right side mounting brackets (6 & 8) using AN 470 rivets.
17. Install all instruments in panel and ensure proper clearance of all support structure. Clearance any part that interferes with proper fit.

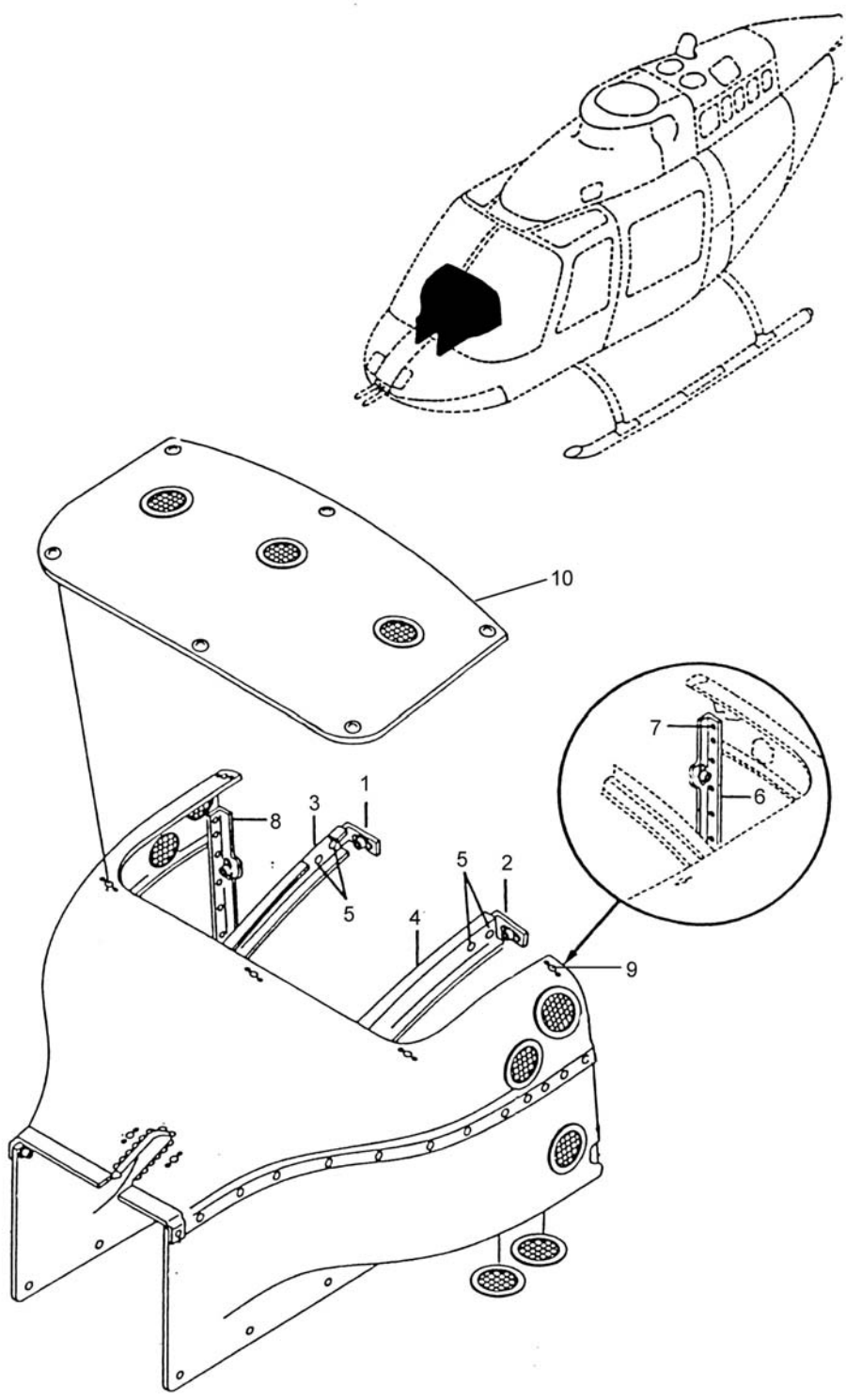

Figure A-2 Panel Tilt Modification

A glare shield extension must be installed on the instrument panel to reduce glare from the IDUs on the canopy at night. This extension can be fabricated as shown below, or can be purchased pre-assembled. Contact Chelton Flight Systems Technical Support at (208) 389-9959 for information on pre-assembled glare shield extensions.

BELL 206/407 GLARE SHIELD EXTENSION OVERLAY FABRICATION AND INSTALLATION INSTRUCTIONS

The following procedure describes a fabrication and installation procedure whereby a new glare shield, which is 4-1/8" deeper than the original equipment, is fitted over, and attached to, the existing original glare shield.

NOTE: *Before beginning the described modification, please read the following instructions and study figure A-3, "Glare Shield Extension Overlay." In addition, please review and follow all adhesive and fastener manufacturer's instructions when assembling the new glare shield assembly. Allow adhesives to cure undisturbed.*

---

1. Following the fabrication of a new instrument panel, and before populating the panel with the FlightLogic EFIS-II and other flight instruments, remove the existing glare shield from the original instrument panel as follows:

   a. Remove the existing caution panel screws and caution panel and set aside for later reattachment.
   b. Drill out and remove the eight existing glare shield to panel mounting rivets.
   c. Apply heat to soften existing adhesive until glare shield is free from the instrument panel.

2. Using the original instrument panel as a template, match drill the glare shield to panel rivet holes on the new instrument panel.

3. Using Magnabond, two part structural adhesive (Magnolia Plastics P/N 200000297 or equivalent) and standard 100 degree countersink rivets (AN470 P/N MS20426AD4 or equivalent) install original glare shield onto new instrument panel.

4. Review figure A-3 to get a general idea of how the extension overlay shield will fit onto the existing glare shield.

5. Fabricate the new glare shield extension overlay as follows:

a. Obtain a 1/8" thick section of Kydex 100 aircraft grade opaque black plastic, or equivalent. A data sheet for Kydex 100 is included in Table 1 of Appendix A of this document.
b. Cut a piece of plastic that will overlap and extend beyond the existing glare shield by at least 4-1/8 inches.
c. Slowly heat and form the plastic to fit over the existing glare shield as shown in figure A-3.
d. When satisfied with the fit of the overlay, allow the plastic to cool and then scribe a line on the new plastic, 4 1/8" away from, and parallel to, the edge of the existing shield. (The edge closest to the pilot) It may help to make a reference mark on the overlay plastic at the 4-1/8'' point and then slide the overlay back until the reference mark and the edge of the existing shield are in alignment. The existing shield can then be used as a template to draw the scribe line on the overlay.
e. Cut the new plastic extension overlay along the scribe line and trim along the backside in order to fit flush with the back edge of the panel and existing glare shield.
f. Radius the bottom corners of the overlay to allow for full control movement of both pilot and Co-Pilot's cyclic.
g. Test fit the glare shield extension overlay, and the instrument panel and existing glare shield in the aircraft. Verify clearance for all aircraft controls.
h. Using the existing glare shield and caution panel as a template, drill caution panel screw holes through the newly fabricated glare shield overlay.
i. Using 3M Scotch-Grip Rubber & Gasket Adhesive (P/N 1300L or equivalent) attach the new glare shield extension overlay to the existing glare shield. A technical bulletin with Kydex recommended adhesive and mechanical bonding methods is included in Table 1 of Appendix A of this document.

6. Attach the caution panel with MS35214-16 screws. Use clamps where appropriate to hold assembly until adhesive cures.

7. Apply rubber trim (Synthetic Rubber Channel Extrusion, Cessna Part No. R581462 or equivalent) to front edge of the new glare shield overlay assembly.

8. After completion of the instrument panel modification, ensure all placards from the original panel are installed. Install an additional placard as shown below:

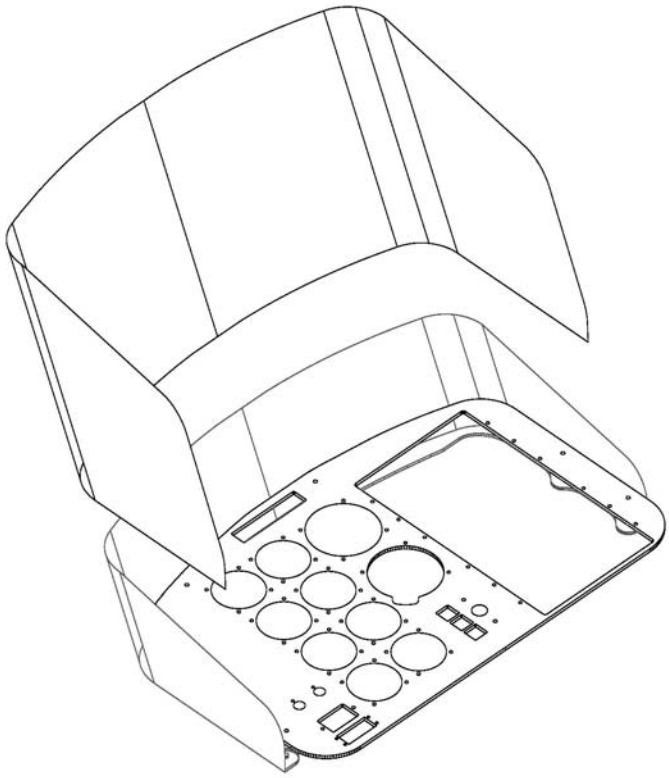

Figure A-3 Glare Shield Extension Overlay

Install a locally produced placard on the Instrument Panel as shown in Figure A-4.

EFIS DISPLAYS APPROVED FOR VFR OPERATIONS ONLY

Figure A-4 EFIS Placard

Install a locally produced placard on the Instrument Panel as shown in Figure A-5 for Bell 407 aircraft.

**CLIMB RATE NOT TO EXCEED
+2000 FPM**

Figure A-5 Bell 407 Limitation Placard

AIRCRAFT INSTALLATION

Install the IDUs. GPS, GPS Antenna, AHRS, and Air Data Computer using the steps outlined in Chapter 2 of this document. Install the GPS Antenna using the Dart GPS Antenna Mount, P/N D206-508-011, or equivalent. Dart Aerospace LTD can be located on the Web at www.dartaero.com.

Figure A-5 shows typical sensor /display installation locations on the Bell 206/407 airframe. Following the installation on a specific airframe, it is recommended that the installer mark the actual sensor locations on figure 5, to keep on file with the aircraft records and Rotorcraft Instructions for Continued Airworthiness (ICA), Chelton Doc. No. 150-045284.

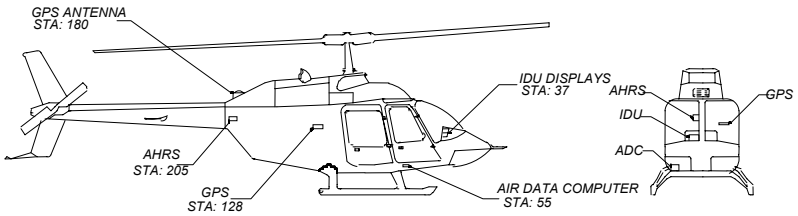

Figure A-5 Typical Sensor/Display Installation

TABLE 1: KYDEX DATA SHEET AND APPLICATION NOTES

KYDEX 100

HIGH IMPACT FIRE-RATED SHEET

Offering superior performance in formability, rigidity, impact resistance, fire retardance, and chemical resistance.

GENERAL INFORMATION:

Super tough, durable Kydex 100 acrylic/PVC alloy sheet brings new dimensions to thermoformers in: formability, rigidity, breakage resistance, chemical resistance and fire retardancy. This high performance thermoplastic sheet is available in a wide range of standard and custom colors; textures; and sheet sizes. It is Underwriter's Laboratories Inc.® recognized for UL Std 94 V-0/5V and UL746C and has 18 ft-lbs/in Notched Izod impact resistance.

FEATURES:

SUPERIOR FORMABILITY – For deep or hard to form parts or where good finished detail is required, Kydex 100 is unsurpassed.

RIGIDITY – Kydex 100 is more rigid than most other thermoplastics resulting in parts that will deform less when loaded.

BREAKAGE RESISTANCE – With a Notched Izod impact resistance of 18 ft-lbs/in, Kydex 100 offers unsurpassed resistance to breakage.

CHEMICAL RESISTANCE – Kydex 100 meets the highest standard for chemical resistance for thermoplastic materials.

FIRE RETARDANCY – Kydex is recognized by Underwriter's Laboratories Inc.® for Standard 94 V-0 and 5V and UL 746C in all gauges and colors.

THERMOFORMABILITY – Excellent forming properties result in uniform wall thicknesses and crisp detail, plus easy machining and fabricating using conventional methods, further expanding finished part possibilities.

ELECTRICAL PROPERTIES – Kydex 100 exhibits a Dielectric Strength of 565 V/mil and Dielectric Constant of 3.28 @60 Hz, 3.13 @1000 Hz, 2.78 @ 1 MHz, 2.42 @800 MHz, 1.9 GHz.

Property	Test Method	Typical Value[1]
Specific Gravity	ASTM D-792	1.35
Tensile Strength, psi	ASTM D-638	6,100
Elongation %	ASTM D-638	160
Flexural Strength, psi	ASTM D-790	9,100
Modulus of Elasticity, psi	ASTM D-790	335,000
Notched Izod Impact Resistance, @ 73°F, ft-lbs./in	ASTM D-256	18
Rockwell Hardness (R Scale)	ASTM D-785	94
Coefficient of Linear Thermal Expansion in./in./°F	ASTM D-696	4.2×10^{-5}
Taber Abrasion Resistance, wt. Loss %, grams/1000 cycles	ASTM D-1044	0.038%
Heat Deflection Temperature (HDT) @264 psi, annealed °F	ASTM D-648	173
Flammability: Underwriter's Lab. Component Recognition	UL Standard 94[2]	V-0,5V[3]
Motor Vehicle Safety Standard	MVSS 302	Pass
Federal Aviation Administration	FAR 25.853(a)	Pass[3]

[1]All values based upon 0.125" sheet unless otherwise specified.
[2]Underwriter's Laboratories Inc., File E115252
[3]All gauges 0.028" and above.
Not intended for specification purposes.

Kleerdex Company Customer Service Aiken, SC 29802
800-325-3133 or 803-642-6864
fax: 803-642-6867 or 800-452-0155

3/4/02 /

KYDEX 100 ADHESIVE BONDING

KYDEX®
TECHNICAL SERVICE DEPT.

Due to its excellent chemical resistance, Kydex can be more difficult to cement than other plastics. Strong bonds can be obtained for most applications using the methods shown below. Kydex can also be joined to itself or to other materials using mechanical fasteners in place of adhesives.

Solvent Cementing:
When bonding Kydex to itself, excellent joints and adhesion can be obtained using solvents in one of the following ways:

• The best joints can be obtained using a viscous solvent cement consisting of about 10% Kydex shavings or sawdust dissolved in a 50/50 mixture of tetrahydrofuran (THF) and methyl ethyl ketone (MEK). The Kydex shavings should be dissolved in the straight THF first, before adding the appropriate amount of MEK. Both of these solvents are available from lab supply companies such as Fisher Scientific, Aldrich Chemicals, or other chemical distributors.

• Without the Kydex shavings, a relatively fast-acting capillary adhesive can be made by using only the 50/50 THF and MEK mixture. THF works well at 100%,but it tends to flash off too quickly resulting in a poor joint. Addition of MEK slows down the evaporation rate and affords greater time to work with the joint.

Adhesives:
In addition to chemical solvents, good bonds (both Kydex to itself and Kydex to other materials) can be obtained from various commercially available adhesives. Some examples are:

• *Cyanoacrylate* adhesives (e.g. “Super Glue”), such as Henkel’s S1000 Power Series (Henkel 800-934-9401), yield very high joint strength for bonding Kydex to itself or to other materials. They are especially suitable for smaller areas of application where a very fast cure is desired.

• *THF* based adhesives by IPS work extremely well for Kydex to Kydex applications. Any of the following IPS Weld-On adhesives can be used: #4052, #4007, and #1007. For more information on these products, please contact IPS at (800) 421-2677. Tangit manufactured by Henzel, and HAKU 2091 manufactured by Chemische Werke Kluthe GmbH are other products. These adhesives also work well for Kydex to PVC and Kydex to ABS applications.

• *Urethane* based adhesives are available in easy-to-use two-part cartridge dispensers and result in good bonds. One such example is Ciba’s Uralane 5774 adhesive. Ciba can be reached at (818) 247-6210.
(Europe) 44.1223.832.121

• *Acrylic* based adhesives, like Devcon’s ‘Plastic Welder ‘or ‘Plastic Welder II’ can be used to form very strong bonds with Kydex. Both of the ‘Welder’ products are 2-part adhesives which are available in cartridges. The Welders produce a strong bond which cures in about 15 minutes; the adhesive is white in color. There is a ‘Flex Welder’, which produces a somewhat flexible bond which cures in roughly a half an hour; the adhesive is yellow in color. The Flex Welder

does not give as good a bond as the Plastic Welder and Plastic Welder II. You may order the 'Welder' products from Devcon at (508) 777-1100. (Europe) 011-44-1-933-675299.

• Most hardware stores carry an adhesive for PVC pipe. These types of adhesives usually work successfully with Kydex.

The suggestions and data in this document are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. We recommend that the prospective user determine the suitability of our materials and suggestions before adopting them on a commercial scale.

KYDEX 100 MECHANICAL BONDING

KYDEX®
TECHNICAL SERVICE DEPT.

If solvent bonding or hot gas welding is not feasible for your specific application, Kydex thermoplastics can also be mechanically fastened. Some guidelines are listed below.

Where rigid fasteners are used, consideration must be given to the thermal expansion differential between Kydex and any other material to which it will be joined. To allow for this differential, oversized holes by 1/16" (1.6 mm) in diameter should be drilled into the Kydex. Failure to allow for thermal expansion differentials may result in objectionable buckling during temperature changes.

Where mechanically fastened Kydex assemblies are to be subjected to high stress, the use of nylon or rubber washers or large headed fasteners are recommended to prevent the fastener heads from pulling through the Kydex. Also keep in mind that high tension should not be used when riveting Kydex.

Other options for fastening include the use of foam tapes, adhesives, or Velcro.

Coefficient of Linear Thermal Expansion of Kydex 6200: 4.5 x 10 ^ -5 in/in/°F

The suggestions and data in this document are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. We recommend that the prospective user determine the suitability of our materials and suggestions before adopting them on a commercial scale.

Kleerdex Company Technical Service • 6685 Low Street • Bloomsburg, PA 17815 • 1-800-682-8758

Appendix B

WX-500 Interface

The Chelton EFIS must be configured as the primary controller and display for the WX-500 Stormscope® computer. In this configuration, the indicator offered by L-3 is not required for proper operation, and all additional displays must be wired as receive only.

WARNING!
Stormscope must be strapped to accept heading data from the EFIS.

When connected to the WX-500 Stormscope® computer, the EFIS will receive the data and display the electrical strikes in relation to the aircrafts position.

NOTE: *Always refer to the manufacturer's installation manual for current installation procedures.*

INSTALLATION CHECKLIST

- ☐ Install the WX-500 Stormscope® computer and antenna per the *Stormscope*® Series II WX-500 Installation Manual (P/N 009-11500-001).
- ☐ Connect the J2-22 (INHIBIT) to the mike key lines to minimize possible interference from the Com radios.
- ☐ Connect J3-1 (SYNCHRO) and J3-2 (STEPPER) to ground for heading input selection.
- ☐ Terminate J3-3 (T/B) for proper antenna location.
- ☐ Do not connect Inputs J3-4 (FLAG_SENSE), J3-6 (REMOTE_CLEAR), or J3-7 (SYSTEM_ON).
- ☐ Perform pre-installation testing and system installation per *Stormscope*® Series II WX-500 Installation Manual, § 2.3 and § 2.4.

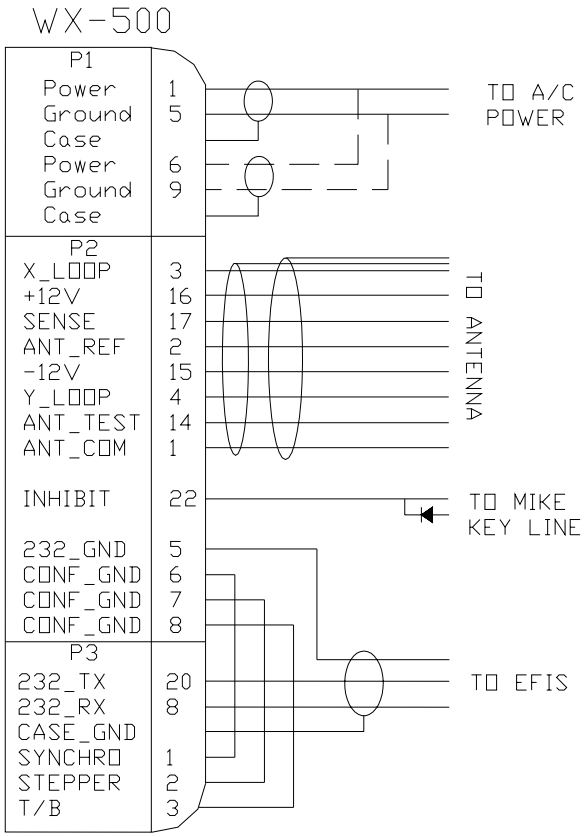

Figure B-1 Typical WX-500 Installation Wiring

POST INSTALLATION TEST

- SCC must be programmed for Stormscope® option from Chelton.
- Insert a SmartMedia card in the IDU and apply power. Verify the IDU displays the Ground Maintenance Functions (GMF) menu.
- From the GMF menu, select the *WX-500 MAINTENANCE UTILITY* option.

1. Rotate the right-hand encoder on the IDU to move the highlight bar to *"SYSTEM INFORMATION"*, then press the encoder knob in to select;
2. Verify jumper settings, antenna mount locations, and voltages as displayed with correct values (See Chapter 5 for additional information);
3. Exit the *System Information* page by pressing the "EXIT" softmenu button on the IDU.

- From the *WX-500 Maintenance Utility* screen, rotate the right-hand encoder to highlight "SET (TOP/BOTTOM) ANTENNA*"* then press the encoder in to set.

WARNING!
System will not operate properly unless the antenna position is set.

- Perform the "STRIKE TEST MODE" and "NOISE MONITOR MODE" tests per the Stormscope® Series II WX-500 Installation Manual, § 3.3, and Chelton EFIS Installation Manual, Chapter 5.

- Exit the WX-500 Maintenance Utility menu by rotating the IDU right-hand encoder to highlight "EXIT" and press the encoder.

NOTE: *Perform troubleshooting in accordance with the Stormscope® Series II WX-500 Installation Manual, Chapter 4, and the Chelton EFIS Installation Manual, Chapter 5.*

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Appendix C

Traffic Interface

This Appendix describes the requirements to interface the Chelton Electronic Flight Information System (EFIS) to a Traffic Advisory System (TAS) or Traffic Collision and Avoidance System (TCAS-1). Refer to the appropriate section for the type of traffic system to be interfaced.

RYAN 9900B(X) TCAD

The Chelton EFIS can be used as the control and display for the Ryan 9900B(X) Traffic and Conflict Alert Device (TCAD) computer. The EFIS system takes the place of the Ryan Model 9900B display (P/N 70-2500) or the Ryan Model 9900BX display (P/N 70-2420).

When connected to the Ryan TCAD computer, the EFIS will automatically enable, disable and change TCAD sensitivity. The EFIS also prioritizes and issues "Traffic" warnings.

WARNING!
The TCAD computer must be wired to accept heading from the EFIS only.

NOTE: *Always refer to the manufacturer's installation manual for current installation procedures.*

INSTALLATION CHECKLIST

- ☐ Install the Ryan 9900B(X) TCAD computer and antennas per Ryan TCAD Installation Manual for Series 9900B, P/N 32-2301, or Ryan TCAD Installation Manual for Series 9900BX, P/N 32-2351.
- ☐ Follow all recommendations on antenna length for all four antenna cables.

NOTE: *It is required that there is a 3dB loss through each cable for proper display of the traffic at distances beyond 5 miles, and that there is less than a 0.2dB (approximately 2 inches) difference between all of the antenna cables. Erratic displays and false targets will be displayed on the EFIS system if these requirements are not followed.*

- Install the Com 1 jumper assembly supplied by Ryan.
- Jumper all unused Com ports receiver pins to ground.
- Do not connect P1-3 AUDIO, P1-6 ANNUNCIATOR, and P1-5 REMOTE_MUTE on the TCAD computer.

WARNING!
The TCAD computer MUST have at least RYAN software version 1.10 for the 9900B, and version 1.10 for the 9900BX for proper interface with the EFIS. If the TCAD computer does not contain software version 1.10 or later, contact Ryan Technical Support for upgrade of software.

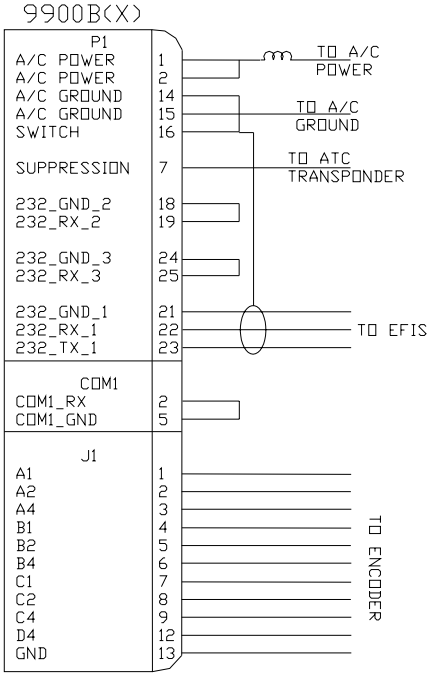

Figure C-1 Typical TCAD Installation Wiring

- Ensure the System Configuration Card (SCC) has been programmed for the Ryan TCAD option. This is accomplished by

powering the system on and verify that a *Traffic* option is displayed in the Faults menu of the MFD.

- Remove power from the IDU, insert a SmartMedia card in the unit, then apply power and verify the IDU displays the Ground Maintenance Function (GMF) menu.
- From the GMF menu, select the *RYAN TCAD MAINTENANCE UTILITY* option and verify the maintenance information displayed on the EFIS screen. (See Chapter 5 for additional information.)
- Test the ATC Transponder and altitude reporting equipment per FAR 43, Appendix E(c) and F to verify proper Mode C operations. Verify proper altitude information by observing the encoder field in the TCAD Maintenance Utility screen.
- Type "Q" to exit the *Ryan TCAD Maintenance Utility.*
- If a TCAD/TCAS flight line tester with Pitot/Static tester is available, verify operation of the TCAD by performing traffic scenarios as outlined in the Ryan 9900 Series Installation Manual, § 4.4.6 or Ryan 9900BX Installation Manual, § 4.3.1 through § 4.3.5.
- During flight tests, verify that targets are presented in proper orientation to the aircraft's direction of flight and altitude; aural and visual annunciations are present during flight, and aural annunciations are turned off when in approach mode.

L-3 SKYWATCH® AND SKYWATCH® HP TAS

The Chelton EFIS can be installed as a display for the L-3 Skywatch® processor TRC497 or L-3 Skywatch® HP processor TRC899. In this configuration, the EFIS will only display traffic information; mode control will be performed by the original WX-1000 controller or through discrete switches. Consult the appropriate Skywatch® processor Installation Manual for control information.

WARNING!
The Skywatch® processor must be wired to accept heading from the EFIS only.

The EFIS will provide ARINC-429 heading information (label 320) and uncorrected baro (label 203) on both the high speed and low speed ARINC ports from the PFD only. Single IDU installations will be

wired similar to the PFD. The installer can connect to either ARINC-429 receive port on the Skywatch® processor.

The TRC497 processor must be strapped to accept ARINC-429 heading data as shown in figure 2. Heading information from any external HSI, directional gyro, or separate AHRS is not allowed.

NOTE: *Do not connect altitude gray code to the Skywatch® processor. Altitude information is transmitted to the processor from the EFIS.*

NOTE: *Do not connect the audio from the Skywatch® processor to the aircraft audio system. Audio callouts are generated from the EFIS.*

The EFIS will accept the Skywatch® data on any of the ARINC-429 receive ports on the J3/J4 connector of the IDU. The receive port will determine the speed of the port when it detects the fist word on the port.

Ensure the SCC is programmed for the traffic option from Chelton by verifying that a *Traffic* option is displayed in the Faults menu of the MFD.

When using the TRC497 processor without the L-3 WX-1000 display/controller, two SPST momentary push button switches must be installed in the flight compartment at a location that can be reached by the pilot for controlling the operation of the processor. These two switches must be labeled “OPR/STB” to take the processor out of standby mode, and “TEST” to place the processor in test mode. Switches and labels are provided by the installer. See the TRC497 Installation Manual for further details.

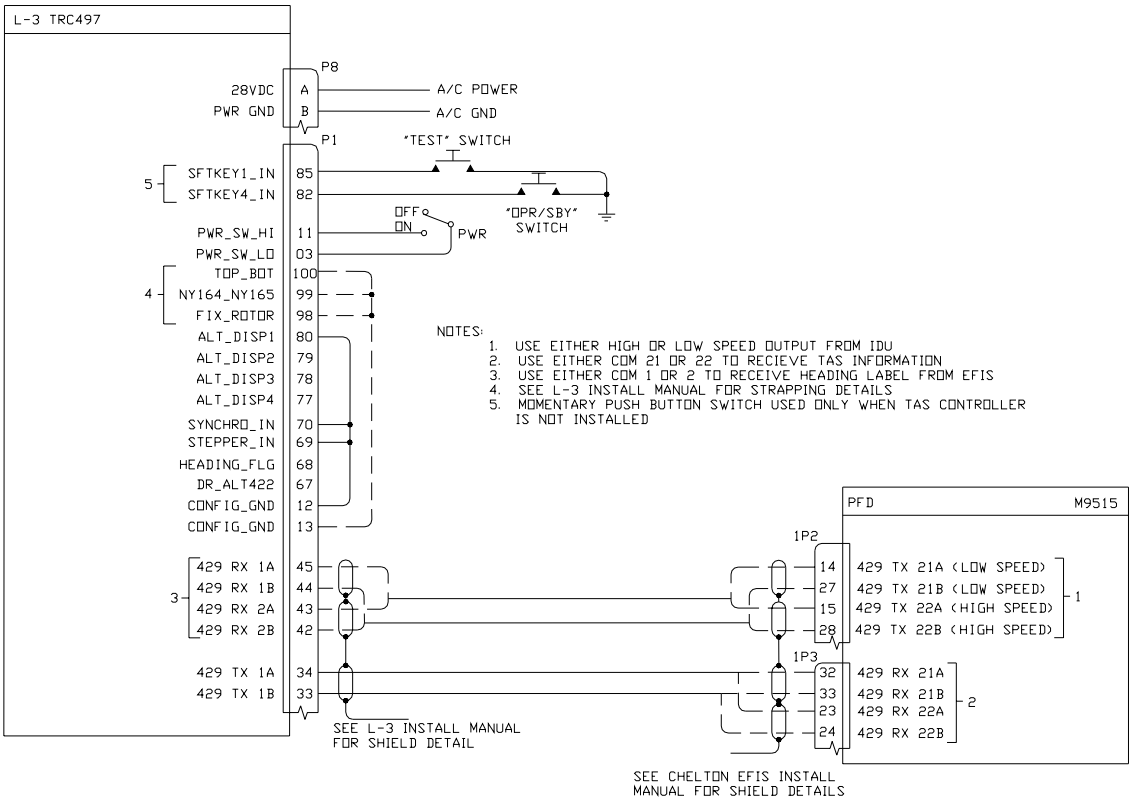

Figure C-2 Typical Skywatch® to EFIS Interface

Interfacing with the TRC899 Skywatch® HP processor is similar to the TRC497. The EFIS will only display the traffic information. Any control of the processor must be provided by the original Skywatch® controller or through discrete switches mounted in the flight compartment as shown in Figure C-3.

WARNING!
The Skywatch® HP processor must be wired to accept heading from the EFIS only.

NOTE: *Do not connect altitude gray code to the Skywatch® HP processor. Altitude information is transmitted to the processor from the EFIS.*

NOTE: *Do not connect the audio from the Skywatch® HP processor to the aircraft audio system. Audio callouts are generated from the EFIS.*

The EFIS will provide the ARINC-429 heading and uncorrected baro information to the processor. Heading data from an external HSI, DG, or AHRS is not allowed in this configuration. Ensure ARINC-429 heading source is selected in the TRC899 configuration menu. See the TRC899 Installation Manual for further details.

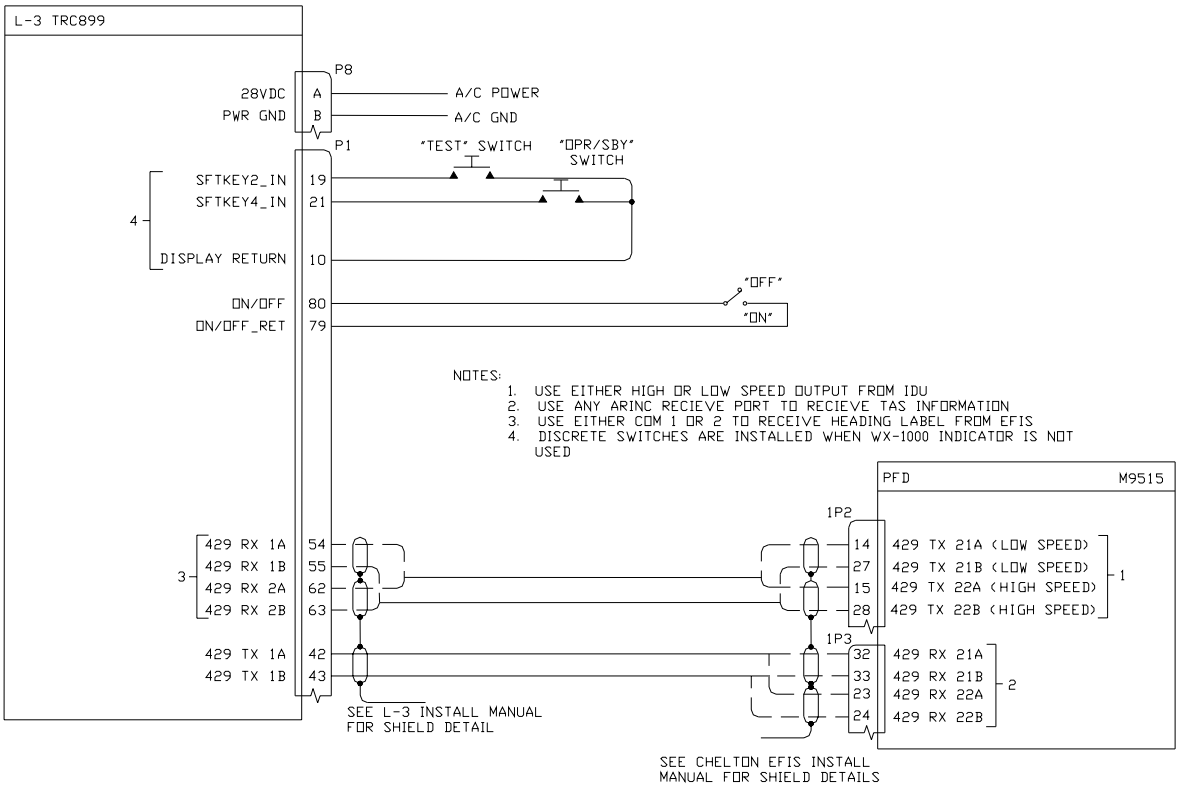

Figure C-3 Typical Skywatch® HP to EFIS Interface

ARINC-429 TAS/TCAS-1 PROCESSOR

The Chelton EFIS can be interfaced to any TAS/TCAS-1 processor with an output that meets the ARINC-735A traffic specification. Heading information to the TAS/TCAS-1 processor must be from the EFIS system, via Com21 (low speed) or Com22 (high speed) from the PFD or MFD if interfacing to a single IDU system.

WARNING!
The TAS/TCAS-1 processor must be wired to accept heading from the EFIS only.

NOTE: *Do not connect the audio from the TAS or TCAS-1 processor to the aircraft audio system. Audio callouts are generated from the EFIS.*

Uncorrected baro (ARINC label 203) is available from the EFIS on the same ARINC-429 port as heading. This can be used in place of standard gray code from the altitude encoder.

ARINC-735A data from the processor can be wired into any of the ARINC-429 receive ports on the IDU. The receive port will determine the speed of the data upon detection of the first label on the port. Ensure the SCC is programmed for the traffic option from Chelton by verifying that a *Traffic* option is displayed in the Faults menu of the MFD.

The EFIS will not control the TAS/TCAS-1 processor. Mode control must be from the original controller or by installing discrete switches as described in the processor Installation Manual.

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Appendix D

Litef LCR-93 AHRS

Aircraft with an airspeed performance greater than 200 Kts or installations where the Crossbow AHRS-500 is undesirable, can interface with the Litef LCR-93 (all part numbers) AHRS for attitude, heading, and acceleration data for the EFIS. This data is sent via ARINC-429 from the AHRS to the IDU in high speed format.

NOTE: *Installation of the Litef LCR-93 AHRS is for attitude and heading reference to the EFIS only. Using the AHRS as an attitude or heading source for external systems such as an autopilot are not approved by STC SA02203AK, STC SR02209AK, or STC SA02220AK. Autopilot or other system interfacing must be previously existing or performed under a separate FAA installation approval.*

The LCR-93 is installed per Litef LCR-93 Installation/Maintenance Instructions, Doc. 142185-0000-840, Section 1. The AHRS (AHRU) must be mounted on a shelf that is rigid to the airframe. Care must be taken to ensure the AHRS is mounted within the tolerances specified in the instructions or corrected by the use of the Litef Misalignment Test Set.

The external Flux Valve (MSU) must be surveyed by the installer and installed in a location that is magnetically quiet such as near a wing tip or in the aft section of the aircraft. If a pre-existing Flux Valve bracket is available, then the use of that bracket is permissible for this installation.

GPS and Air Data information for the AHRS is provided by low speed ARINC-429 from the PFD Com21 TX port (P2-pin 14 and P2-pin 27) connector. Attitude, Heading, and acceleration information for the EFIS is provided by high speed ARINC-429 from the AHRS (J4-pin 8 and J4-pin 29). This data can be connected to any ARINC-429 receive port on the IDUs (COM21RX thru COM28RX). DG/MAG mode select, Slew Left, and Slew Right must be provided by either a Litef Compass Control Unit (optional) or two switches installed on the aircraft instrument panel.

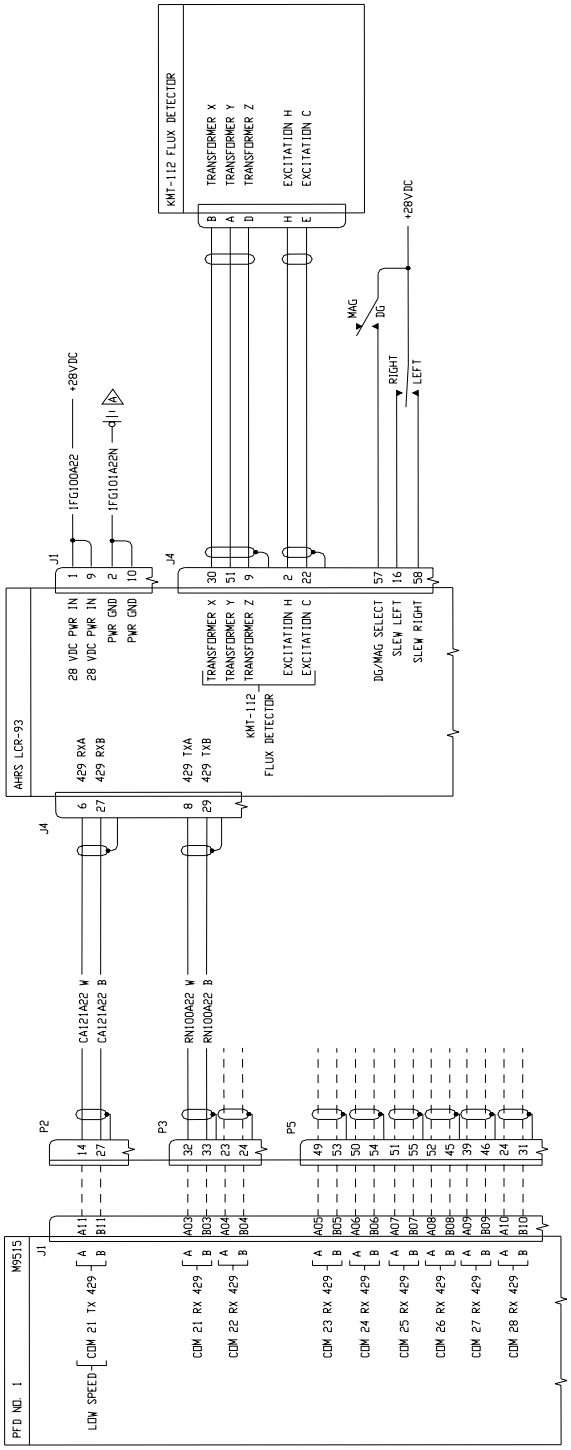

Figure D-1 Basic AHRS Interface

NOTE: *The AHRS is connected to PFD Com21 RX for drawing simplicity. This connection can be made to any ARINC-429 receive port on the PFD or MFD. Interconnect cables are required for multiple IDU installations.*

HDG/MAG Select switch can be a SPST toggle switch or an annunciated alternate-action switch.
Slew LEFT/RIGHT switch can be a SPDT, center off switch or an annunciated rocker switch with center off.

Alignment of the AHRS and Flux Valve are described in the Installation/Maintenance Instructions, Sections 1 and 2. Deviation to the alignments due to EFIS interface is as follows:

EFIS PFD will display a blue screen with a red "X" and the "NO ATTITUDE" flag will appear when the Heading Warn Flag or Attitude Warn Flag from the AHRS are to be displayed. The PFD will display the normal blue over brown screen and the "NO ATTITUDE" flag will disappear when the Heading Warn Flag or Attitude Warn Flag from the AHRS are deactivated.

Align the compass per Chapter 6 of this manual, Litef Service Information Letter 141450-0000-840-010 Iss 1, and the Litef LCR-93 Installation/Maintenance Instruction Doc. 142185-0000-840.

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Appendix E

Cessna Model 501

This appendix describes specific installation requirements of the EFIS in a Cessna Model 501 Citation aircraft per STC SA02220AK. This appendix is used in conjunction with the rest of the Installation Manual to provide the documentation required for the installer to interface the EFIS to the existing equipment in the Cessna Citation aircraft.

The EFIS can be installed in a 501 as a 2-screen, 3-screen, or 4-screen system with the FreeFlight GPS receiver, Shadin ADC, and Litef LCR-93 AHRS. The Shadin ADC can be substituted with a Shadin ADC-6000 or Innovative Solutions and Systems (IS&S) RVSM compatible ADC as an option. The Litef AHRS will be interfaced to a Sperry SPZ-500 autopilot with the optional Synchro card.

NOTE: *STC SA0220AK authorizes the interface of the Litef LCR-93 to the Sperry SPZ-500 autopilot for pitch and roll reference. Any other autopilot interface will be performed under a separate FAA installation approval.*

INSTRUMENT PANEL MODIFICATION

The existing instrument panel will be modified as outlined in Chapter 2 of this manual. All mounting location requirements for the PFD, MFD(s), backup instruments, and IDU cooling apply as described in Chapter 2, Task 3. If electric backup instruments are to be used, they must be electrically isolated as described in Chapter 2, Task 7.

In a 2 or 3-screen installation, the PFD and one MFD are installed on the Pilot's Instrument Panel. The optional third screen will be installed in the Center Instrument Panel between the Pilot and Co-Pilot. The right (co-pilot's) panel will retain an alternate set of instruments, such as an existing set of electromechanical indicators, with independent sensor sources. A set of backup indicators will also be retained for heading (compass), attitude, airspeed, and altitude, as described in Chapter 2, Task 3.

In a 4-screen installation, the PFD and one MFD are installed on the Pilot's Instrument Panel and the two additional MFDs are installed on the Co-Pilot's panel as shown in Figure E-1. The system sensors will

typically include one or two AHRS, one or two ADC, one or two GPS receivers, and an AIU. Two backup attitude, airspeed, and altitude indicators must be installed as described in Chapter 2, Task 3. In this configuration, one set of attitude, airspeed and altitude indicators are retained on the Pilot's Instrument Panel, and the other set may be installed on the Co-Pilot's Instrument Panel. All backup instruments must be connected to isolated power sources from the EFIS.

Figure E-1 Typical 4-Screen EFIS Panel Installation

Removal of the existing Pilot's ADI will require installation of a new autopilot mode annunciation panel. An annunciation panel shall be mounted above the Pilot's PFD using Korry LED or Eaton incandescent annunciators as shown below.

Figure E-2 Typical Autopilot Annunciator Panel

SENSOR INSTALLATION

Mounting of individual sensors (GPS, ADC, AHRS, etc.) will vary between aircraft depending on existing equipment configurations.

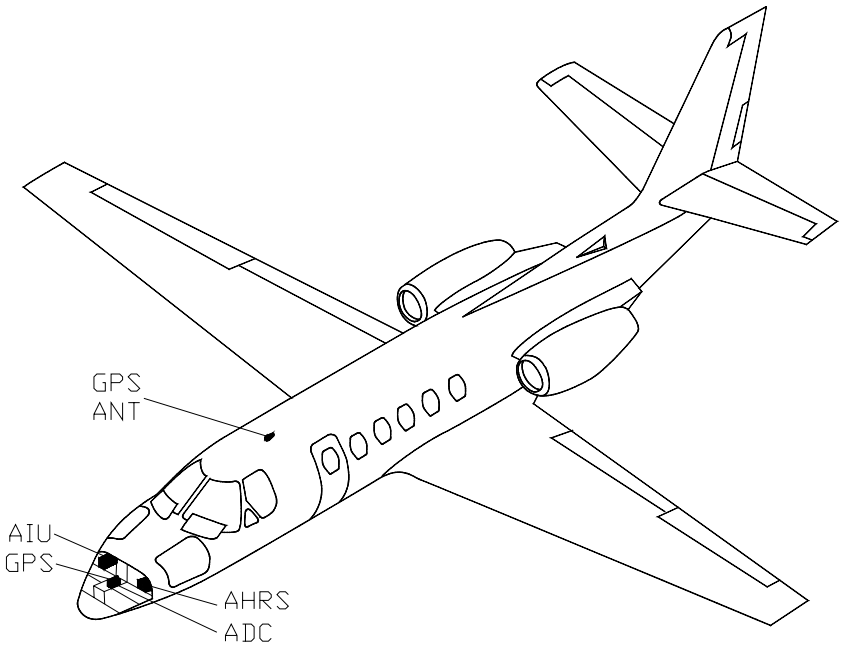

Figure E-3 Typical EFIS Sensor Location

Figure E-2 shows a typical EFIS sensor location drawing. The ADC, AIU, AHRS, and GPS receiver are mounted in the forward avionics bay near FS 49.0 on existing shelves. The installer must verify that all mounting structures can withstand the static load tests as described in Chapter 2 of this manual or the appropriate Installation Manual of the specific sensor.

Air Data Computer

The Shadin ADC-2000 can be used as the altitude, airspeed, OAT, and fuel flow source for the EFIS as described in Chapter 2, Task 9. Ensure that the Pitot and Static lines, OAT probe, fuel flow transducers are installed as described in Chapter 2, Tasks 11 thru 13.

The EFIS can use an optional ADC source via ARINC-429, which will provide altitude, airspeed, and OAT. Fuel totalizer will not be available unless the Shadin ADC-2000 is included. If both the ARINC-429 ADC and Shadin ADC are installed, the EFIS will use the data from the ARINC-429 source first and use the Shadin information

for fuel totalizer and as an ADC backup if the AIRNC-429 source fails.

If the ARINC-429 ADC is used, it will be connected to the IDU(s) on any of the ARINC-429 receive ports available (Com21 thru Com28).

FreeFlight GPS

The FreeFlight GPS receiver is used as the GPS/WAAS source for the EFIS. Installation of the GPS receiver and antenna are described in Chapter 2, Tasks 14 and 16. Figure E-1 shows the GPS antenna mounted on the centerline of the aircraft at FS 157.0. Ensure the GPS/WAAS antenna meets the minimum 36 inch separation distances from transmitting antennas.

Litef AHRS Model 142185-XXXX

The Cessna 501 installation requires the Litef LCR-93 AHRS as the attitude and heading source for the EFIS and Sperry SPZ-500 autopilot. Mounting and alignment of the AHRS is described in the Litef LCR-93 Installation/Maintenance Manual. The AHRS with the Synchro card option will replace the pilot's Vertical Gyro (VG) and Directional Gyro (DG).

Analog Interface Unit

The Chelton AIU should be installed as close to the Navigation radios as possible. The AIU is required to interface the EFIS to the autopilot and provide flap information for TAWS operations. AIU interface is described in the AIU Installation Manual.

Additional Sensors

The EFIS can be interfaced to additional sensors such as the L-3 Stormscope®, L-3 Skywatch®, or Ryan 9900B(X) TCAD. Refer to Appendix B and Appendix C of this manual for additional detail on these interfaces.

Voice Warning and Backlighting

The EFIS voice warning system will be connected to the aircraft audio system as an unmuted audio input. An external EFIS MUTE switch will be mounted either on the Pilot's yoke or in the instrument panel to control the EFIS audio in warning conditions. Additional information is located in Chapter 2, Task 18.

External IDU backlighting and annunciated switches are optional in this installation. Chapter 2, Task 19 and Task 20 further describe these options.

Class-A TAWS

The Class-A TAWS option is approved with the Cessna Citation STC. Additional interfacing include the landing gear "Down and Lock" input and a Glideslope Cancel switch.

The landing gear discrete inputs are paralleled from the existing landing gear down position switches on the aircraft. Refer to the wiring diagrams for further information.

The Glideslope Inhibit switch is a momentary switch that is located on the instrument panel within reach of the pilot. Only one switch is required for this installation. This switch can be a toggle type or annunciated. Refer to the wiring diagrams for further information.

Aircraft Wiring

Existing aircraft wiring can be used when interfacing the AHRS to the aircraft systems. The following diagrams show both Cessna wire numbers and Chelton wire numbers. The installer will determine the suitability of existing wires and add additional wires as needed.

NOTE: *The following wiring diagrams show interconnects using existing aircraft wires and pin termination. Diagrams do not include all wire segments. Refer to Cessna drawings for complete interconnect.*

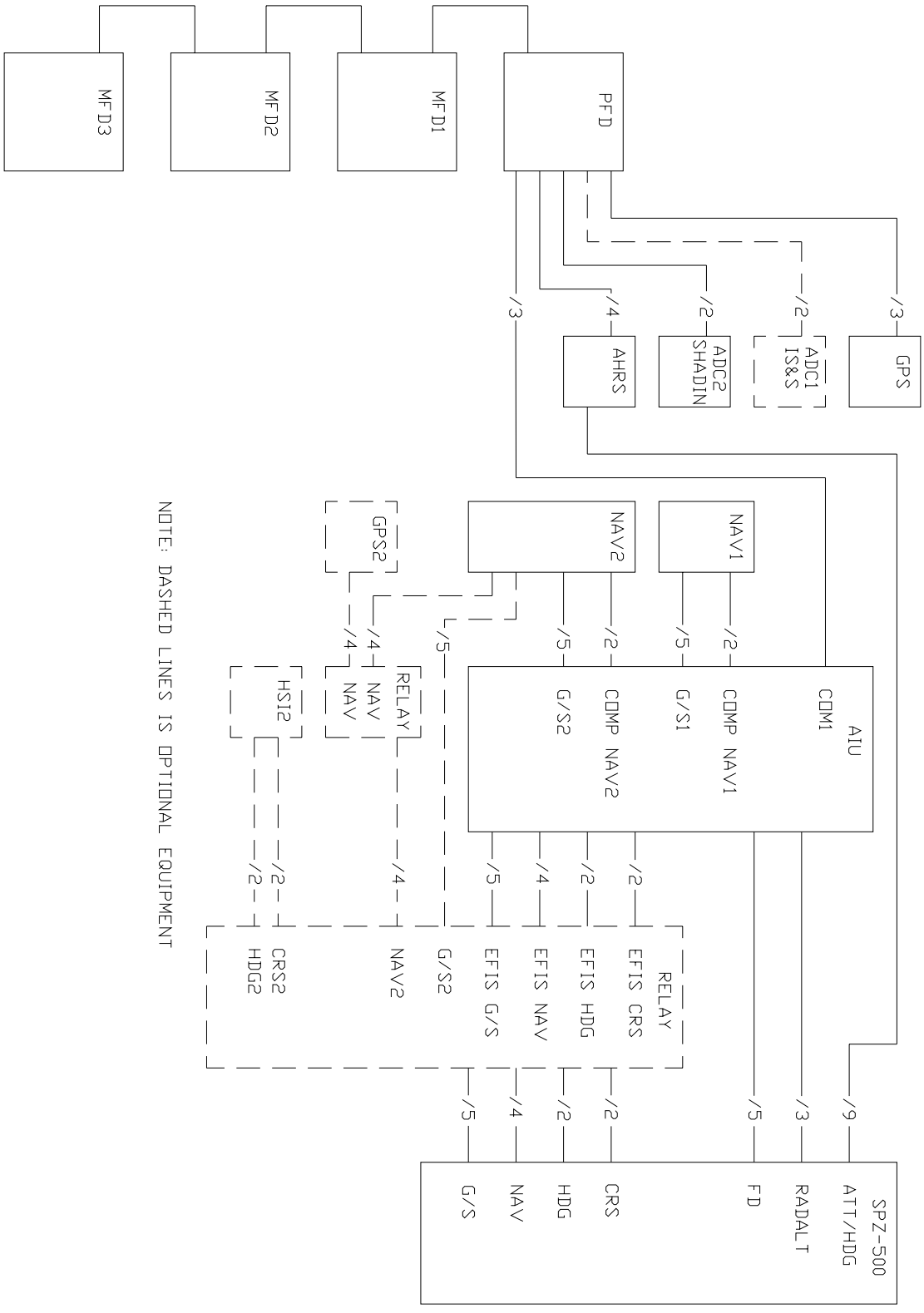

Figure E-4 EFIS Block Diagram

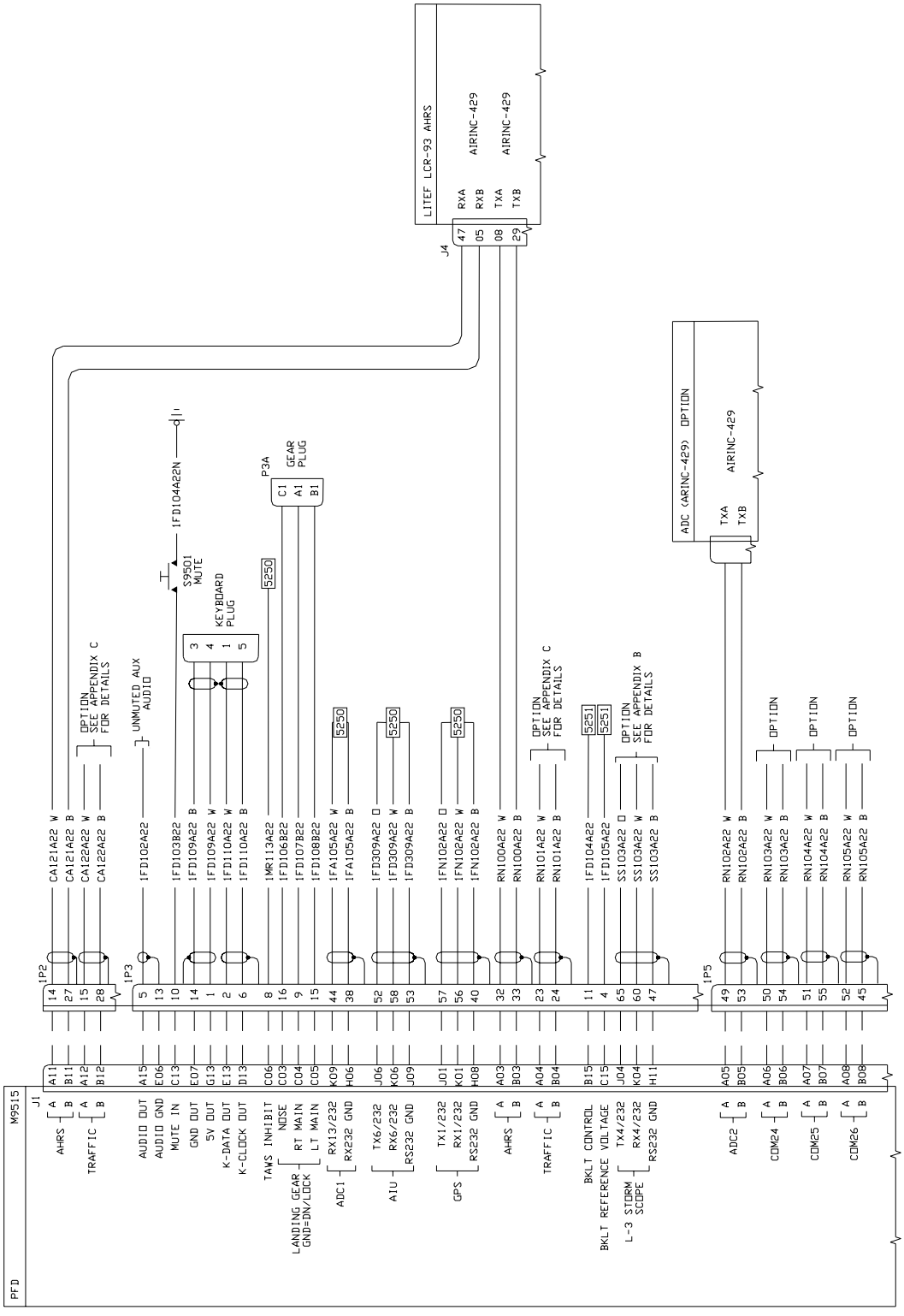

Figure E-5 PFD Interconnect

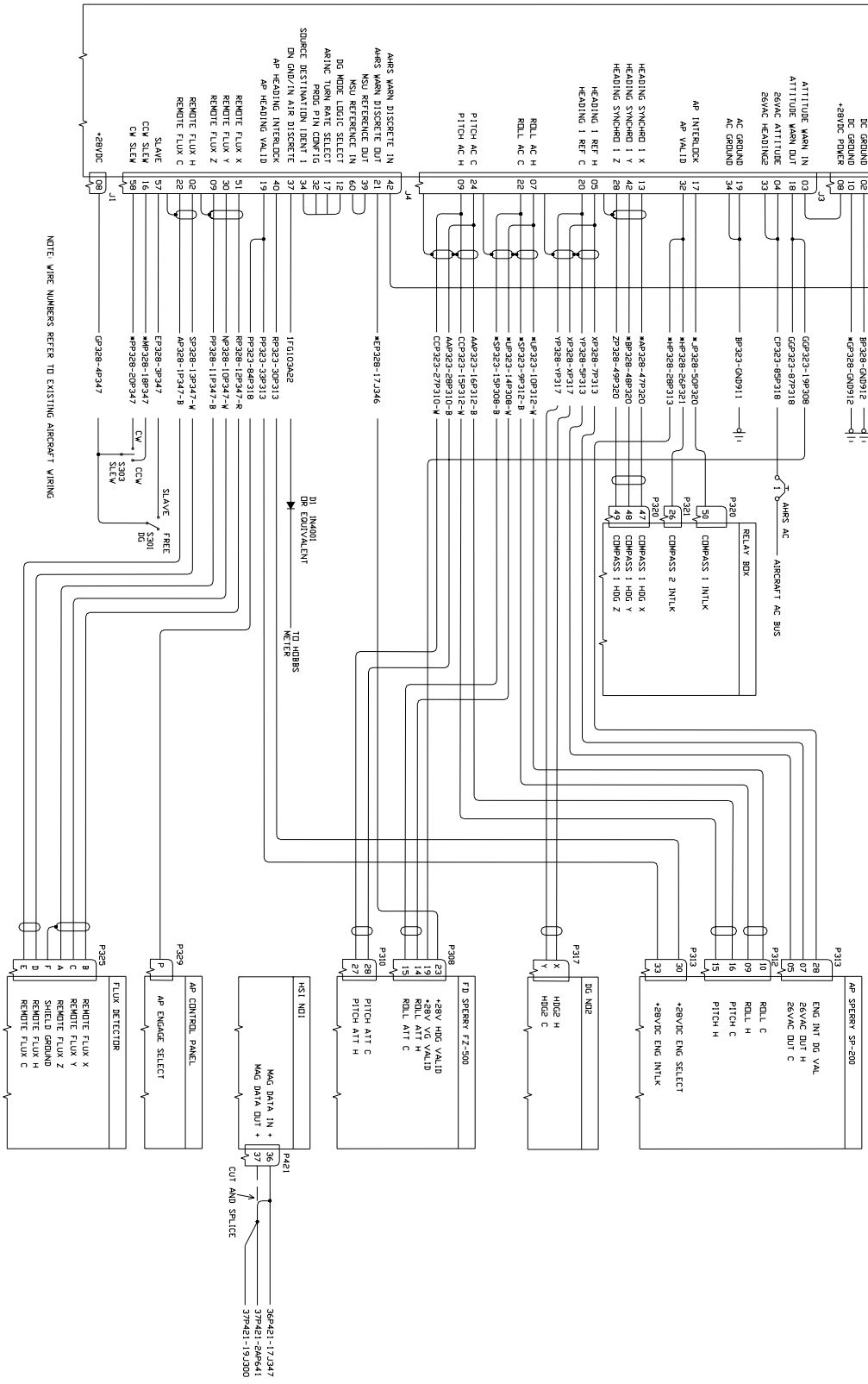

Figure E-6 AHRS Interconnect

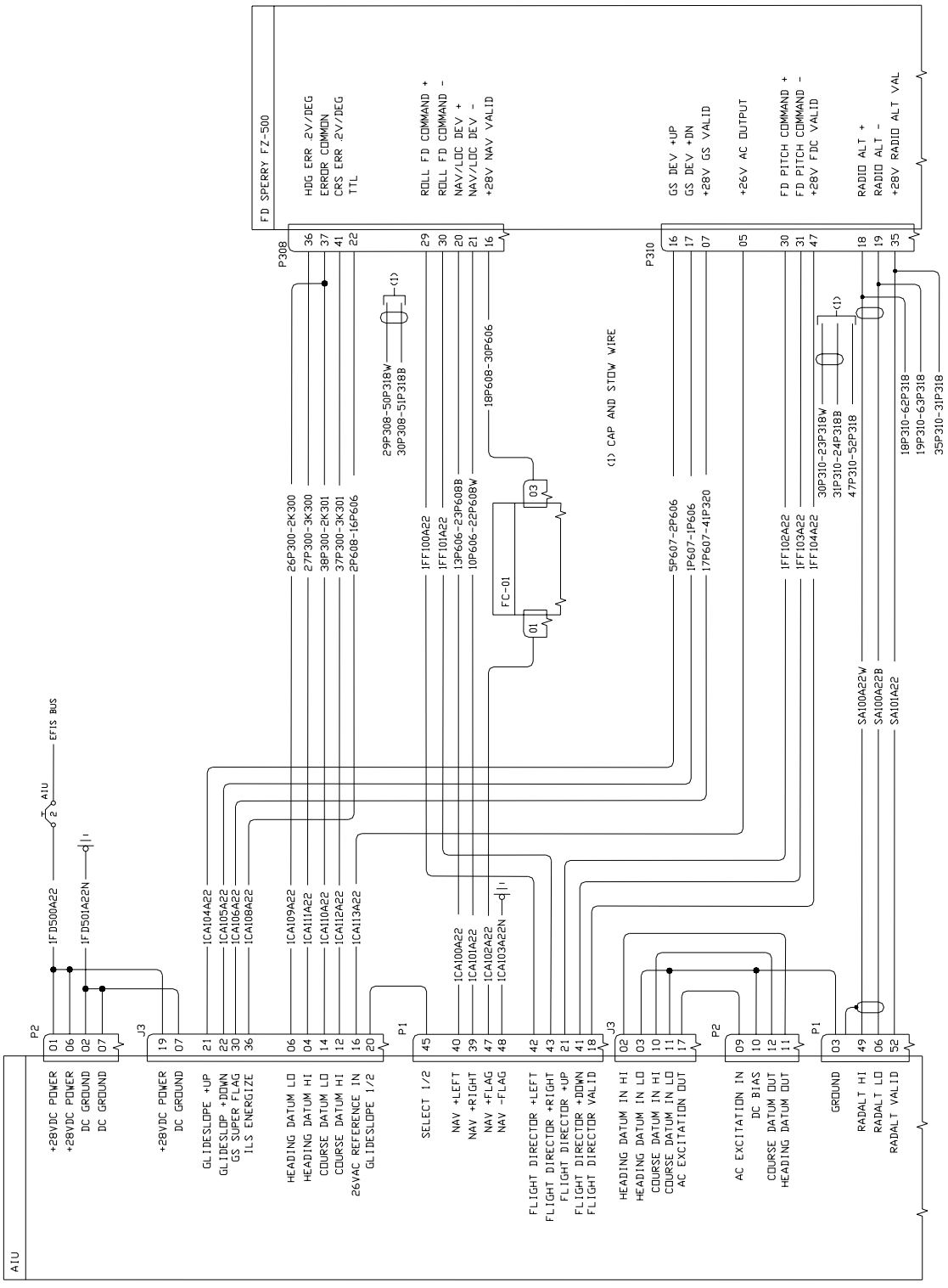

Figure E-7 Autopilot Interconnect

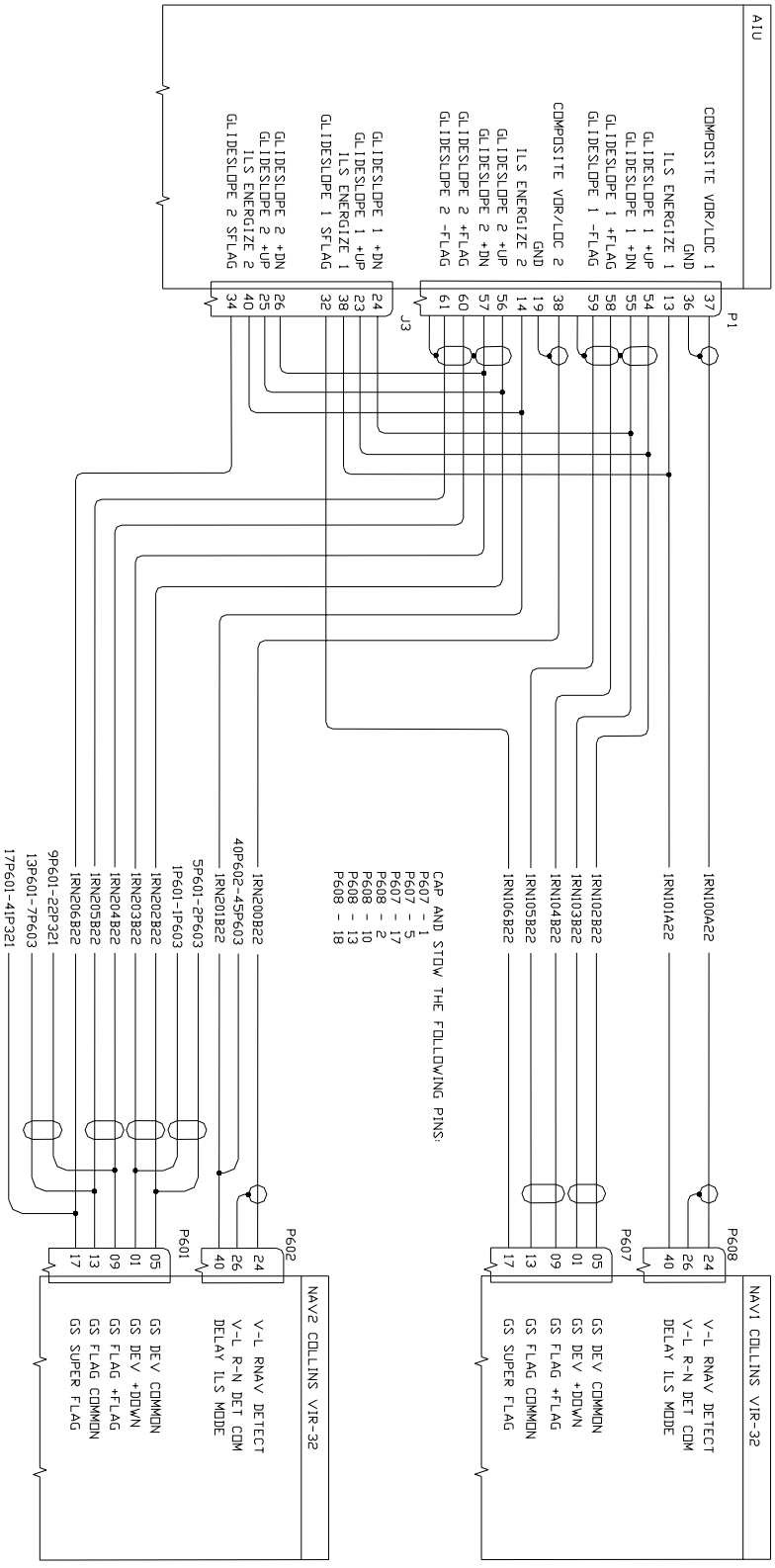

Figure E-8 Nav Interconnect

Appendix F

Eurocopter AS 350/355

This appendix describes the installation of the EFIS in a Eurocopter A-Star AS 350 and AS 355 helicopter for VFR operations.

NOTE: *Use part numbers or equivalent for all hardware noted in this appendix.*

INSTRUMENT PANEL MODIFICATION

The instrument panel will be modified as shown below. The PFD is mounted on the bottom right-hand side with the MFD mounted directly to the left.

Manufacture a new instrument panel using the same type and thickness material as original panel. Match drill mounting holes of new panel to original. Use original hardware to mount instruments as required.

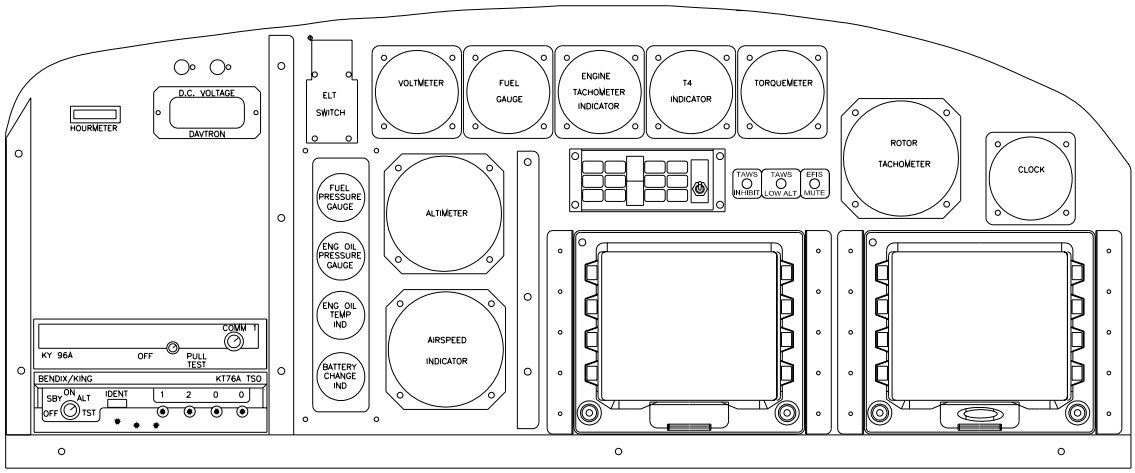

Figure F-1a Typical Instrument Panel Layout (Horizontal Placement)

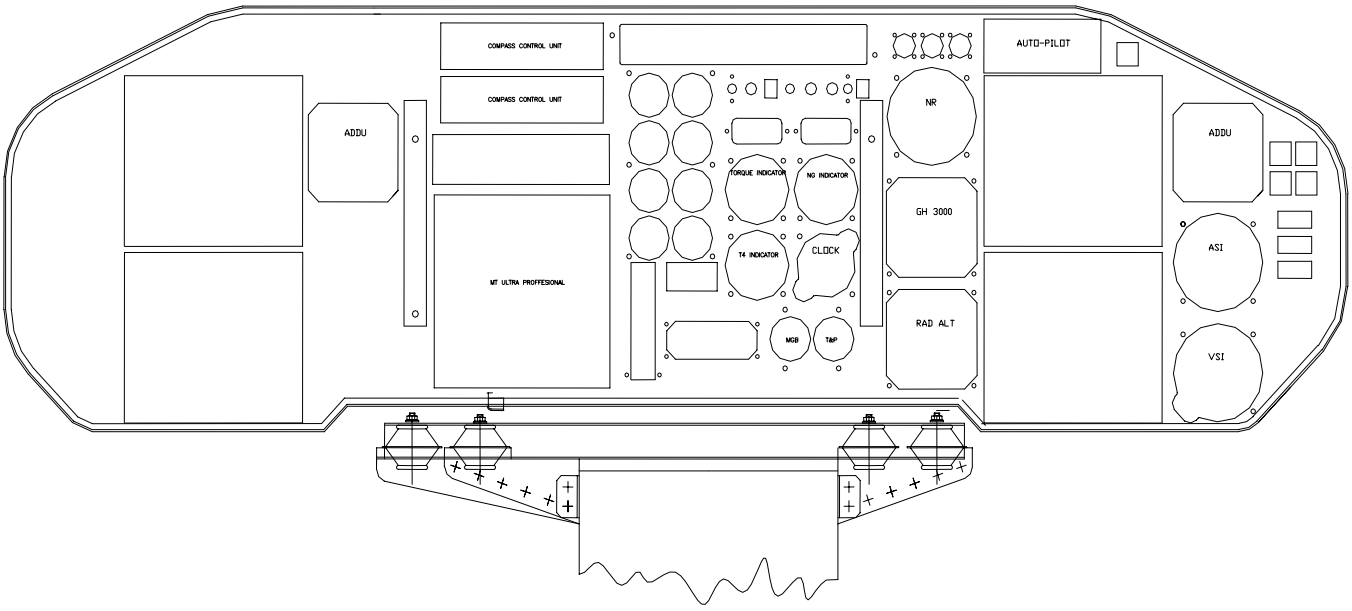

Figure F-1b Typical Instrument Panel Layout (Vertical Placement)

Install a locally produced placard on the Instrument Panel as shown in Figure F-1b.

EFIS DISPLAYS APPROVED FOR VFR OPERATIONS ONLY

Figure F-1b EFIS Placard

IDU Mounting

The IDUs are mounted to the instrument panel using four mounting brackets manufactured by the installer. These brackets are made of 0.060" thick AL.ALLY-7075 T6511 extrusion or equivalent as shown below.

Refer to Chapter 2 and Chapter 4 of this manual for additional information on IDU mounting.

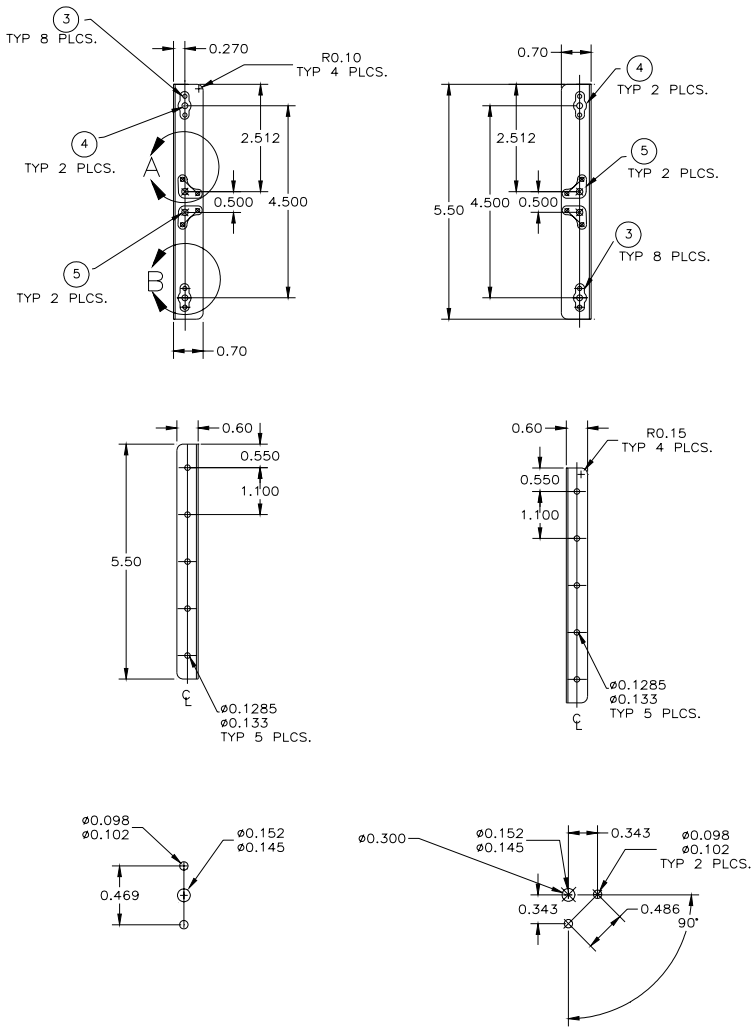

Figure F-2 Typical IDU Mounting Brackets

ITEM	DESCRIPTION	PART NUMBER
3	RIVET, 3/32	MS20426AD3
4	NUTPLATE, 6-32	MS21069L06
5	NUTPLATE, 6-32	MS21073L06

Wire PFD and MFD per Chelton Flight Systems drawings 702-045250, sheets 6 and 7, 702-045251, AIU Installation Manual Doc 570-7000, Chapters 2 and 3, and Chapter 4 of this manual.

Switch Mounting

Mount the TAWS INHIBIT, LOW ALTITUDE, and EFIS MUTE switches on the instrument panel as shown in figure F-1. Wire switches per Chelton Flight Systems drawing 702-045250, sheets 6 and 15, and Chapter 4 of this manual. See Chapter 2, Task 18 for additional information on annunciated switch option.

Circuit Breaker Panel

A new circuit breaker panel for the EFIS bus is required due to limited space on existing fuse panel. Figures F-3a and F-3b show a typical circuit breaker panel and its mounting. Use material as described or equivalent.

Wire circuit breaker panel per Chelton Flight Systems drawing 702-045251 and Chapter 4 of this manual.

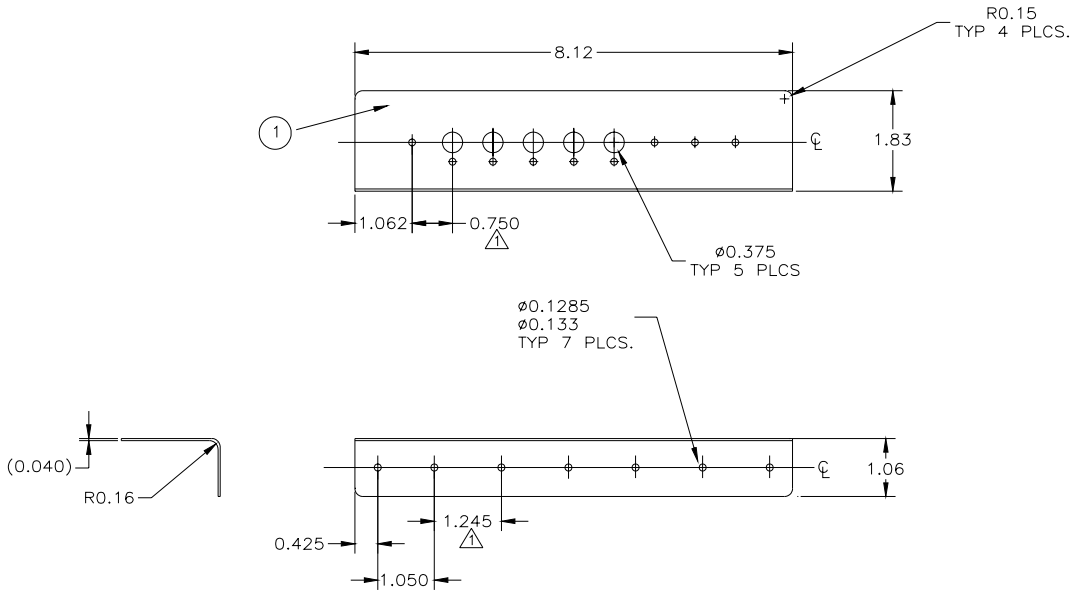

Figure F-3a Typical Circuit Breaker Panel

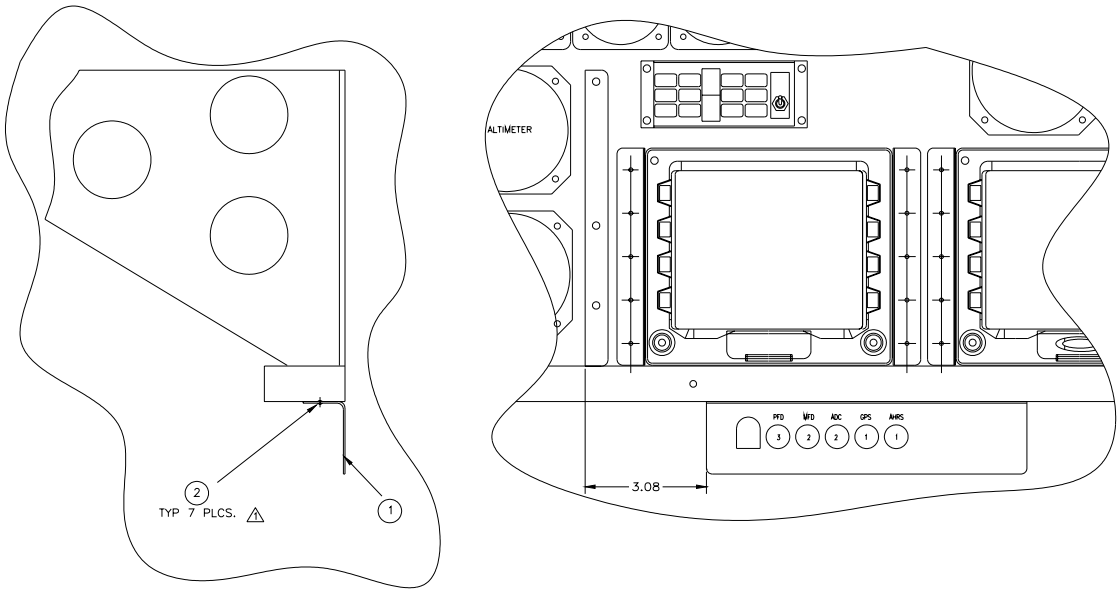

Figure F-3b Typical Circuit Breaker Panel Mounting

ITEM	DESCRIPTION	PART NUMBER
1	SHEET ALUMINIUM 0.040”	AL.ALLY-2024 T3
2	RIVET 1/8	MS202426D4

AIRCRAFT MODIFICATIONS

Sensor locations for the AS-350 are shown in the following diagram.

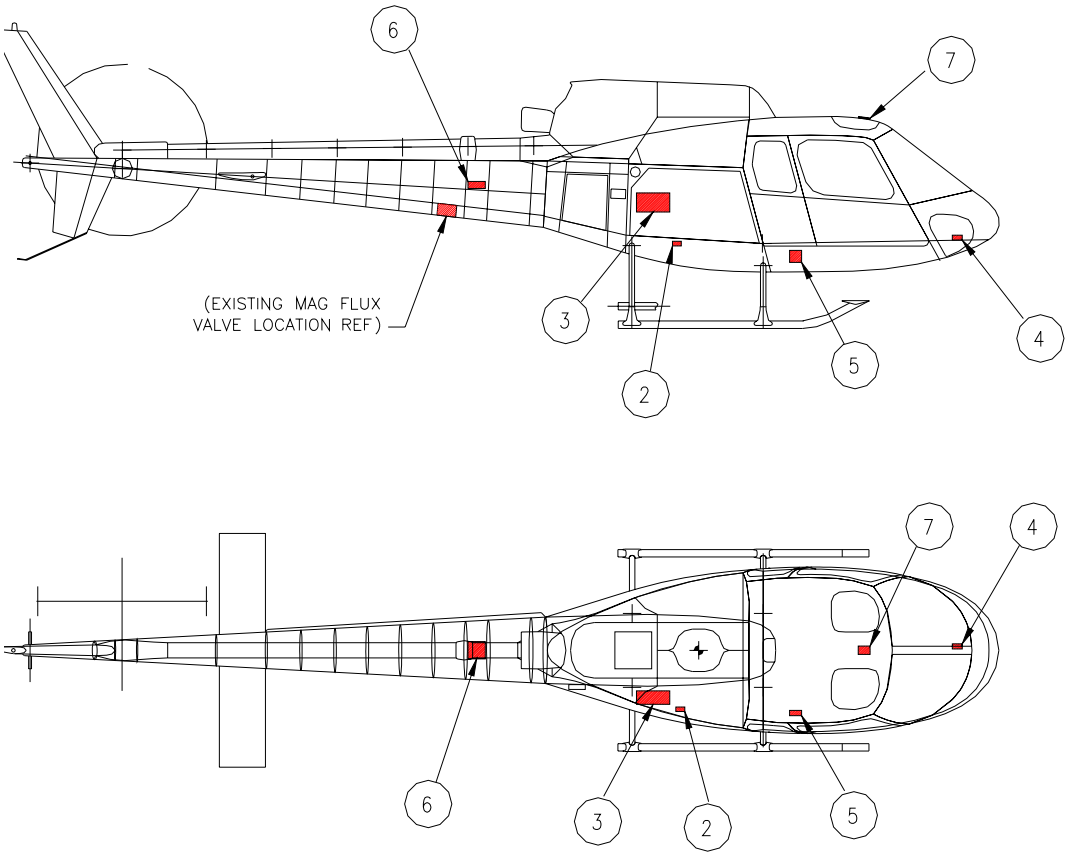

Figure F-4 Equipment Location

ITEM	UNIT
2	Chelton AIU
3	Litef LCR-93 AHRS
4	Shadin ADC
5	FreeFlight GPS/WAAS Receiver
6	Crossbow AHRS-500GA AHRS
7	Comant GPS/WAAS Antenna

ADC Installation

The Shadin ADC-2000 Air Data Computer is mounted below the instrument panel and slightly left of aircraft centerline, on the cockpit floor. Refer to Shadin Installation Manual IM2830-A1S8 or Chapter 4 of this manual for detailed tray dimensions.

Connect ADC to existing Pitot and Static lines as described in Chapter 2 of this manual. Test in accordance with Chapter 6 of this manual.

Refer to Chapter 2 of this manual and Shadin OAT Probe Installation Manual IM1201 for additional information on OAT placement and mounting.

Connect to existing fuel flow transmitter, or obtain a new fuel flow transducer (Shadin P/N "Kit Q").

Wire ADC, OAT probe, and fuel flow transducer per Chelton Flight Systems wiring diagrams 702-045250, sheet 3, 702-045251 and Chapter 4 of this manual.

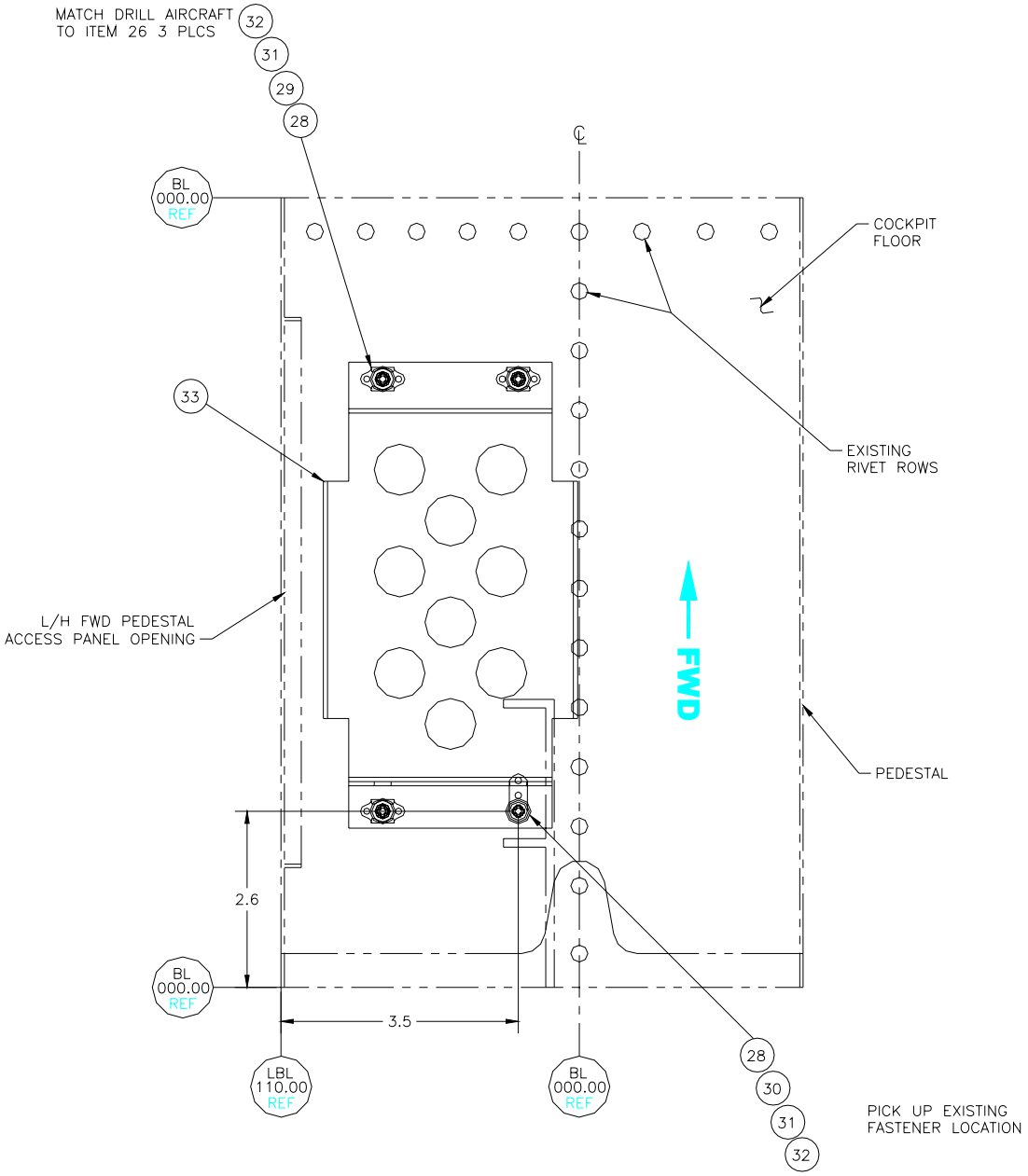

Figure F-5a ADC Mounting Assembly

ITEM	DESCRIPTION	PART NUMBER
28	SCREW, 8-32	MS27039-08-07
29	NUTPLATE, 8-32	MS21075L08
30	NUTPLATE, 8-32	MS21071L08
31	RIVET	CCR264SS3-3
32	WASHER, #8	NAS1149DN816K
33	MOUNTING TRAY	612826

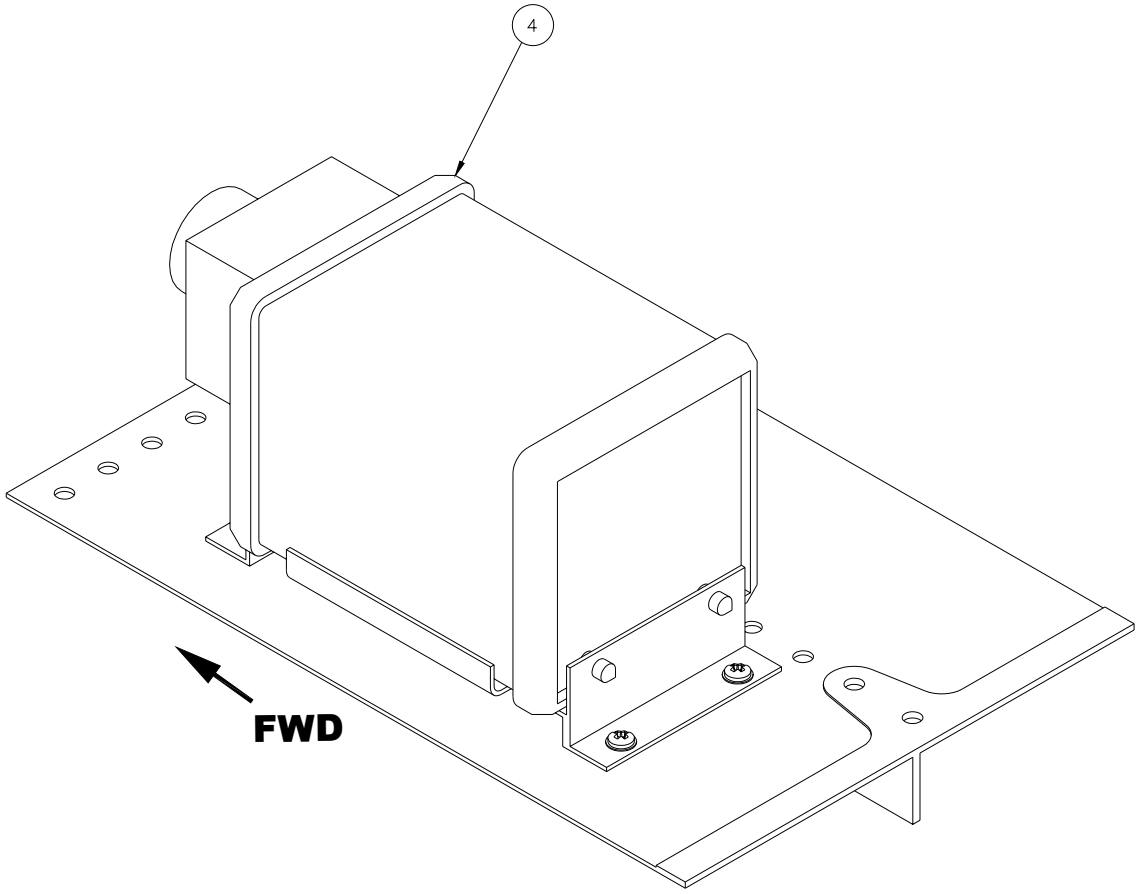

Figure F-5b ADC Installation

ITEM	DESCRIPTION	PART NUMBER
4	SHADIN ADC-2000	962830A-2-S-8

Crossbow AHRS Installation

NOTE: *The Crossbow AHRS-500 is an optional item that may be omitted if the Litef LCR-93 AHRS is installed.*

The Crossbow 500 AHRS is mounted on the center line of the helicopter in the tail boom, aft of Station 744.0. The AHRS is mounted level to the helicopter using brackets manufactured by the installer as shown below.

Wire the AHRS per Chelton Flight Systems wiring drawing 702-045250, sheet 5, 702-045251, and Chapter 4 of this manual.

Align the AHRS per the Crossbow AHRS500GA Installation Manual.

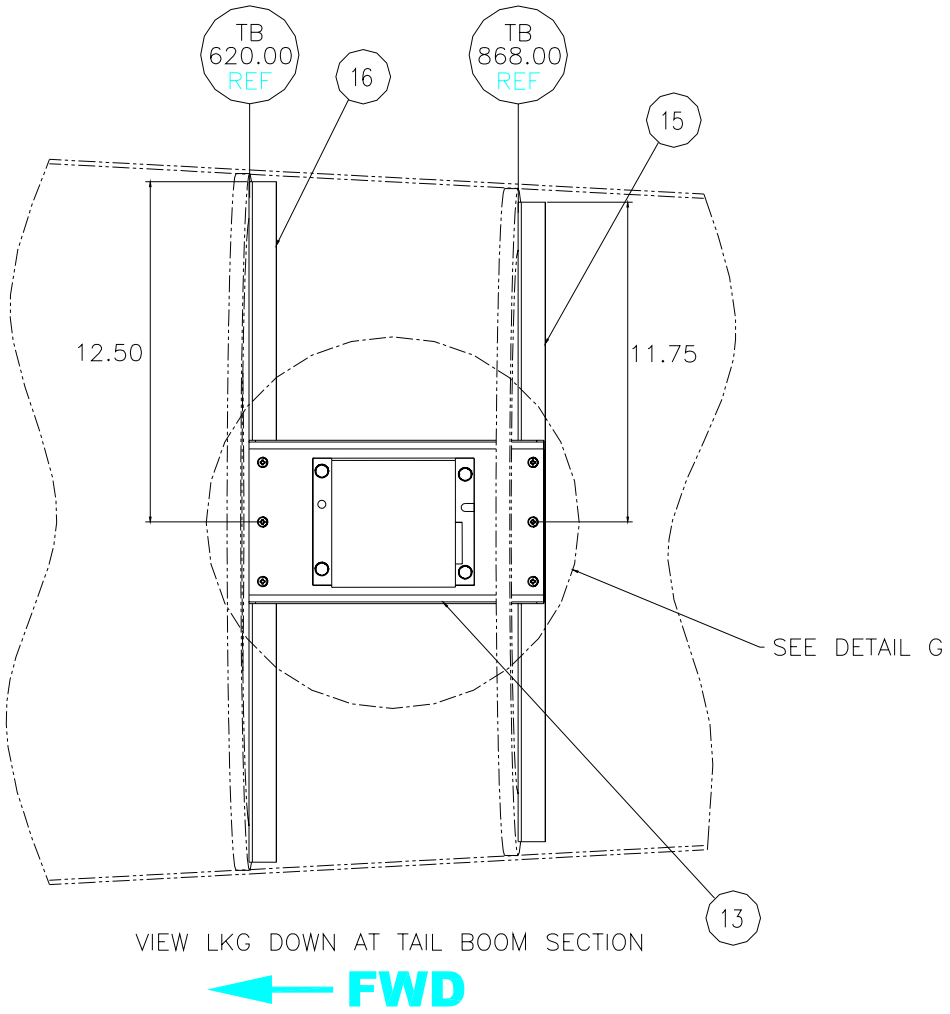

Figure F-6a Crossbow AHRS Mounting Top View (1)

ITEM	DESCRIPTION	PART NUMBER
13	SHELF	
15	SHELF	
16	ANGLE	

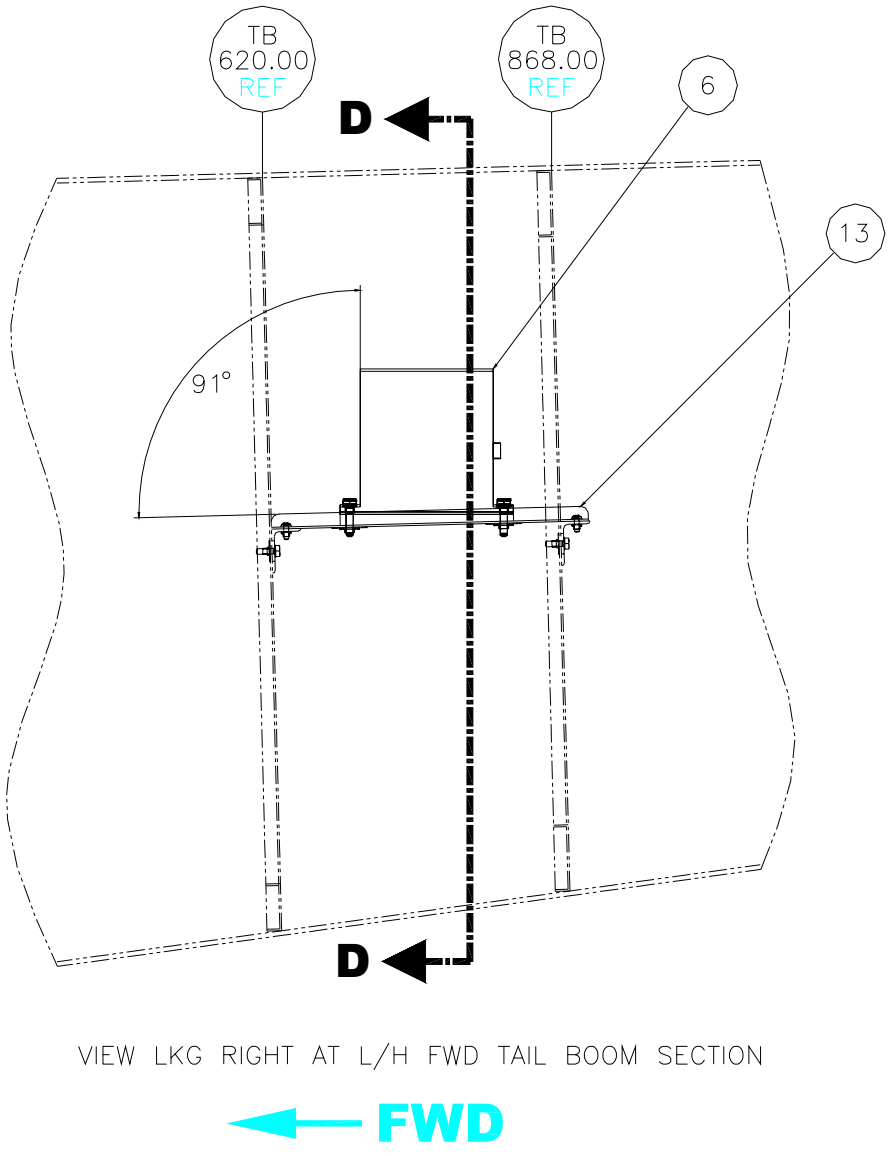

Figure F-6b Crossbow AHRS Mounting Left Side View

ITEM	DESCRIPTION	PART NUMBER
6	AHRS 500-GA	8350-0062-01
13	SHELF	

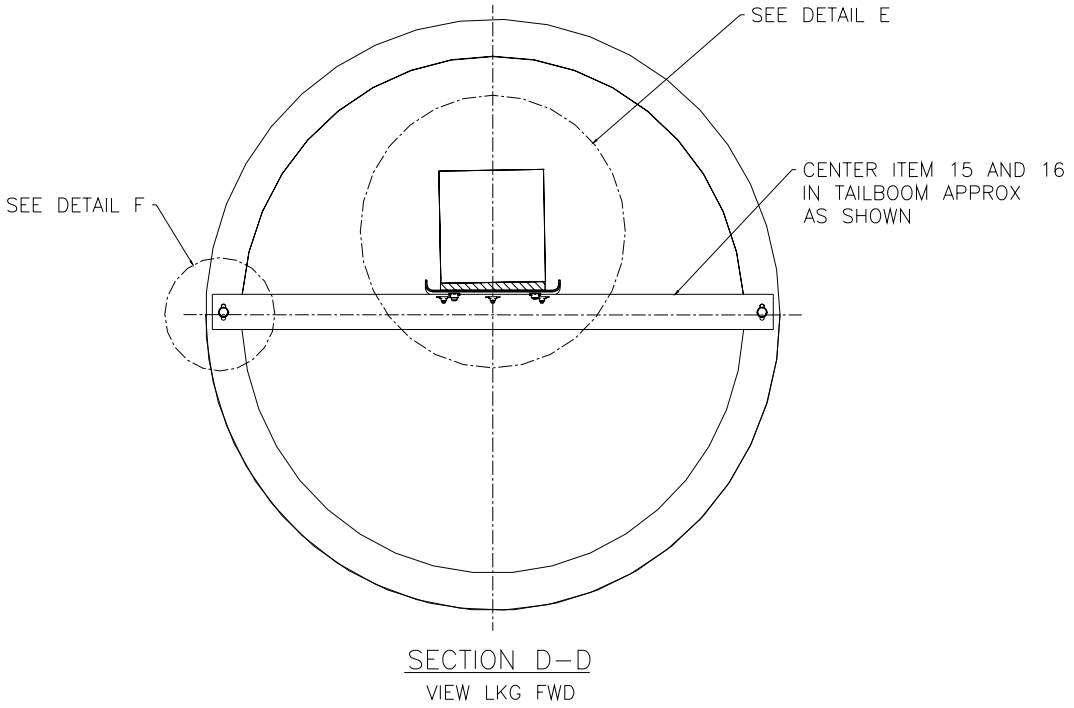

Figure F-6c Crossbow AHRS Mounting Front View

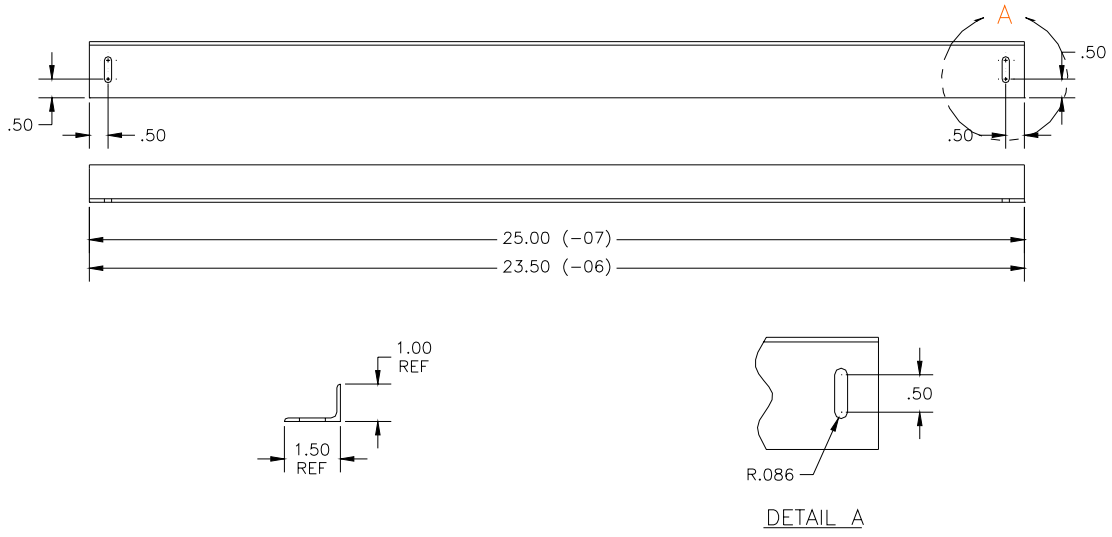

Figure F-6d Crossbow AHRS Angle Brackets

ITEM	DESCRIPTION	PART NUMBER
15 & 16	ANGLE AL.ALLY 2024-T3	AND10134-1403

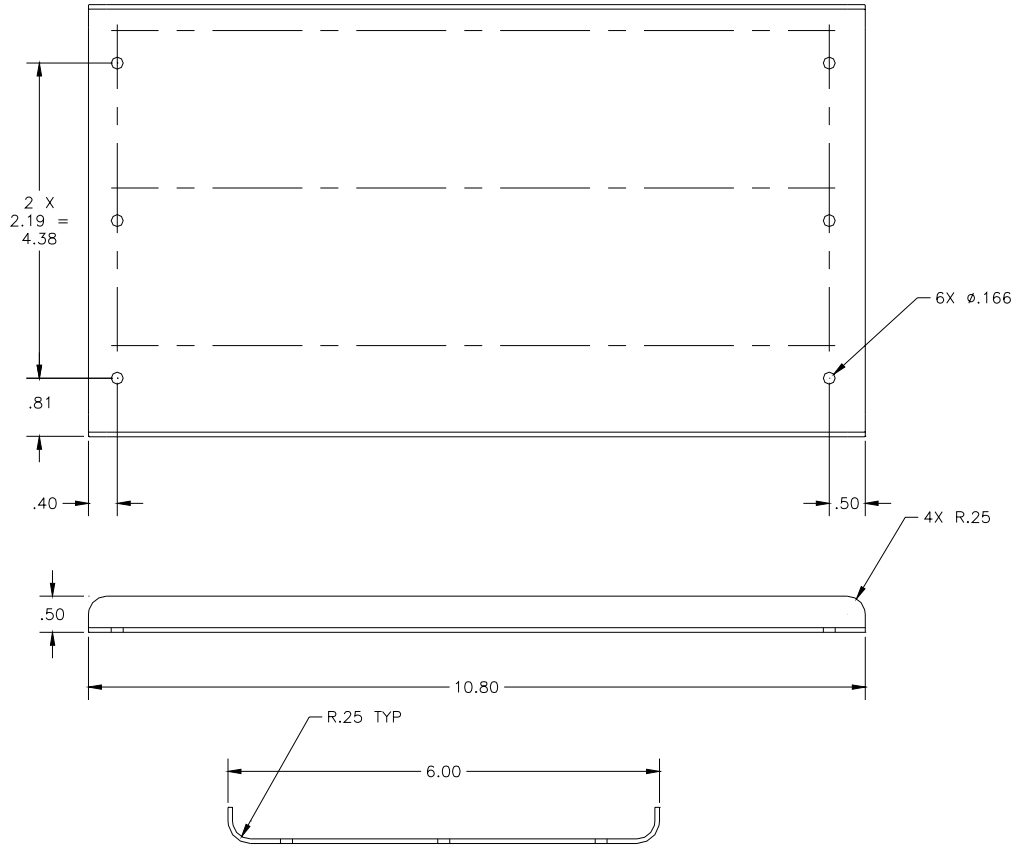

Figure F-6e Crossbow AHRS Mounting Shelf

ITEM	DESCRIPTION	PART NUMBER
13	SHELF 0.063”	AL.ALLY 2024-T3

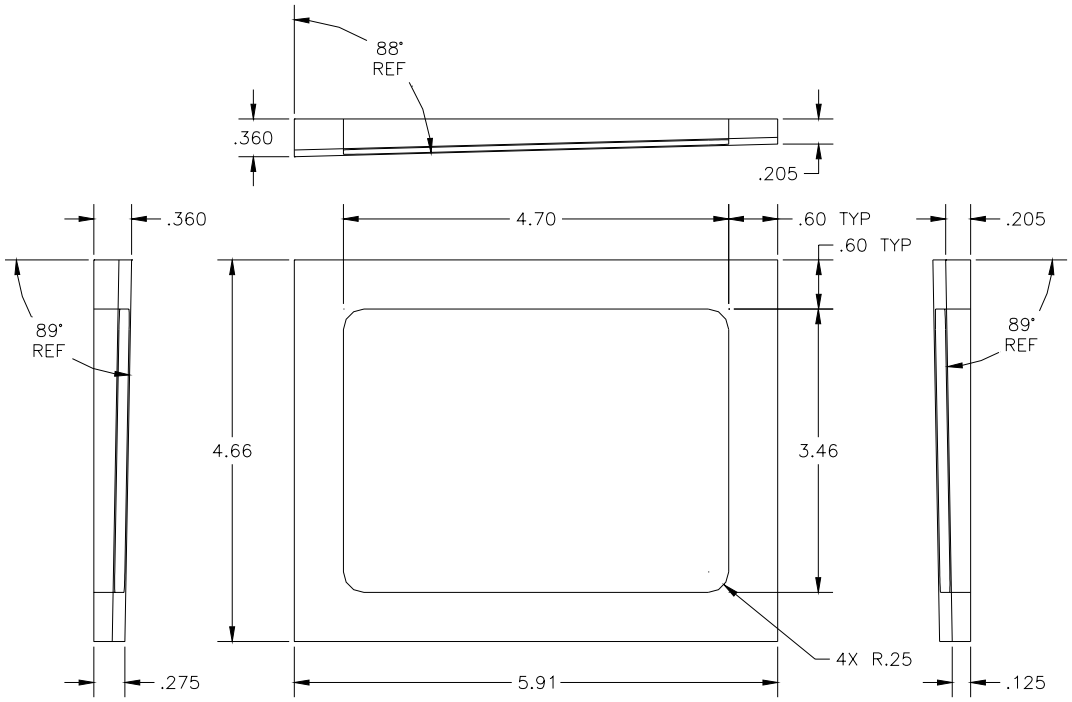

Figure F-6f Crossbow AHRS Mounting Spacer

ITEM	DESCRIPTION	PART NUMBER
14	SPACER 0.375”	AL.ALLY 2024-T3

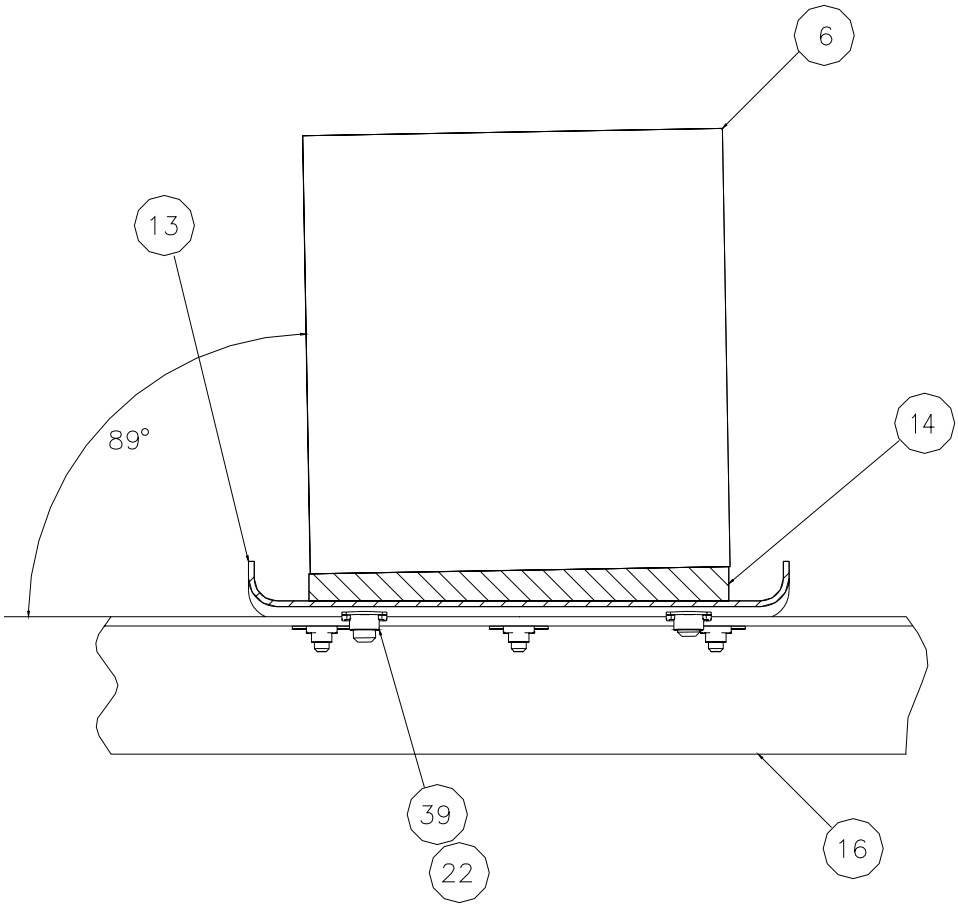

Figure F-6g Crossbow AHRS Mounting Detail E

ITEM	DESCRIPTION	PART NUMBER
6	AHRS 500-GA	8350-0062-01
13	SHELF	
14	SPACER (AS REQUIRED)	
16	ANGLE	
22	RIVET	MS20426AD3-3
39	NUTPLATE	MS21059L4

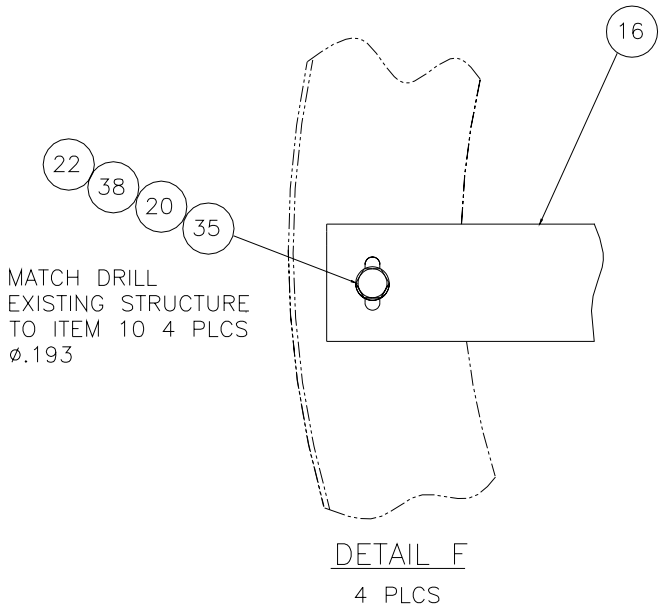

Figure F-6h Crossbow AHRS Mounting Detail F

ITEM	DESCRIPTION	PART NUMBER
16	ANGLE	
20	WASHER	NAS1149D0316K
22	RIVET	MS20426AD3-3
35	BOLT	AN3-4A
38	NUTPLATE	MS21047L3

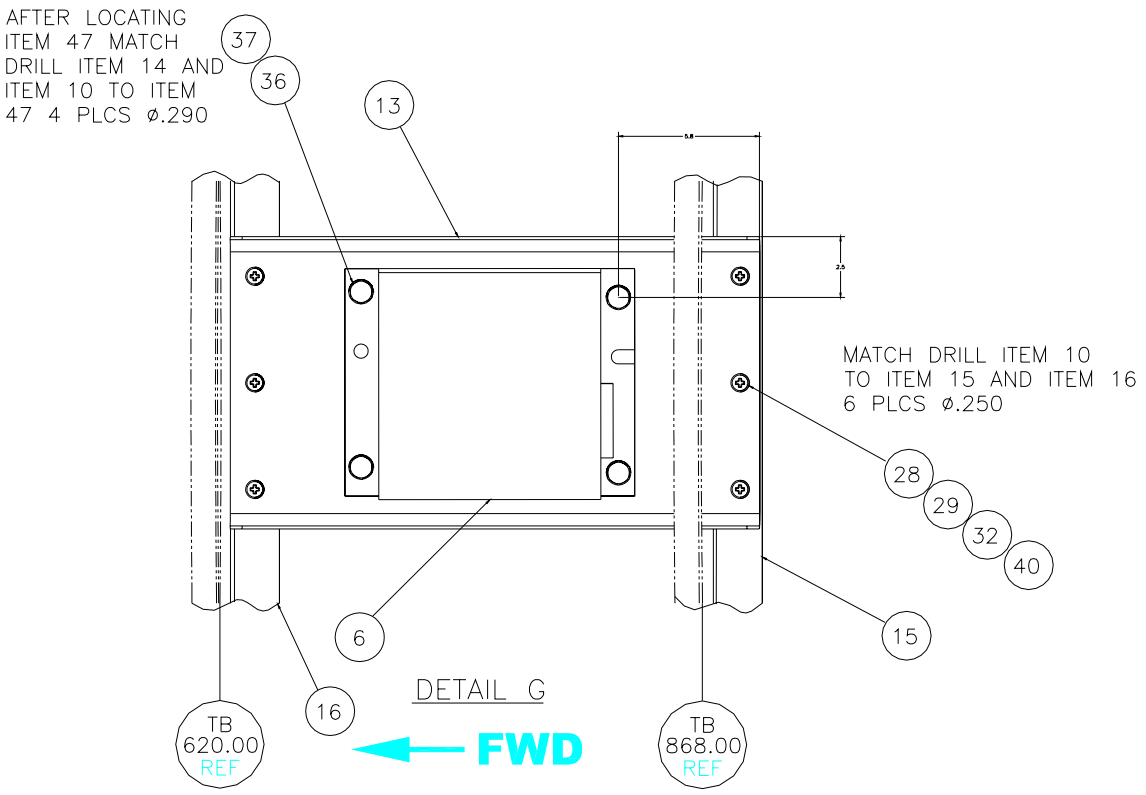

Figure F-6i Crossbow AHRS Mounting Detail G

ITEM	DESCRIPTION	PART NUMBER
6	AHRS 500-GA	8350-0062-01
13	SHELF	
15	ANGLE	
16	ANGLE	
28	SCREW	MS27039-08-07
29	NUTPLATE	MS21075L08
32	WASHER	NAS1149DN816K
36	BOLT	AN4-10A
37	WASHER	NAS1149D0416K
40	RIVET	MS20426AD3-4

Litef LCR-93 AHRS

The Litef LCR-93 AHRS can be installed to replace the Crossbow AHRS-500 in the airframe. If used, the LCR-93 will provide attitude, heading, and acceleration for both the EFIS and autopilot via the ARINC-429 bus.

The AHRS is mounted 16 inches above the right-hand baggage compartment floor, next to the sidewall. A new shelf will be constructed as shown below. Refer to the Litef LCR-93 Installation/Maintenance Instructions Doc. 142185-0000-840 and Appendix D of this manual for further details on the interface of the AHRS.

Wire the AHRS per Chelton Flight Systems wiring drawing 702-045250, 702-045251, Litef LCR-93 Installation/Maintenance Instructions Doc. 142185-0000-840, and Chapter 4 of this manual.

Align the AHRS per Litef LCR-93 Installation/Maintenance Instructions Doc. 142185-0000-840 and Appendix D of this manual.

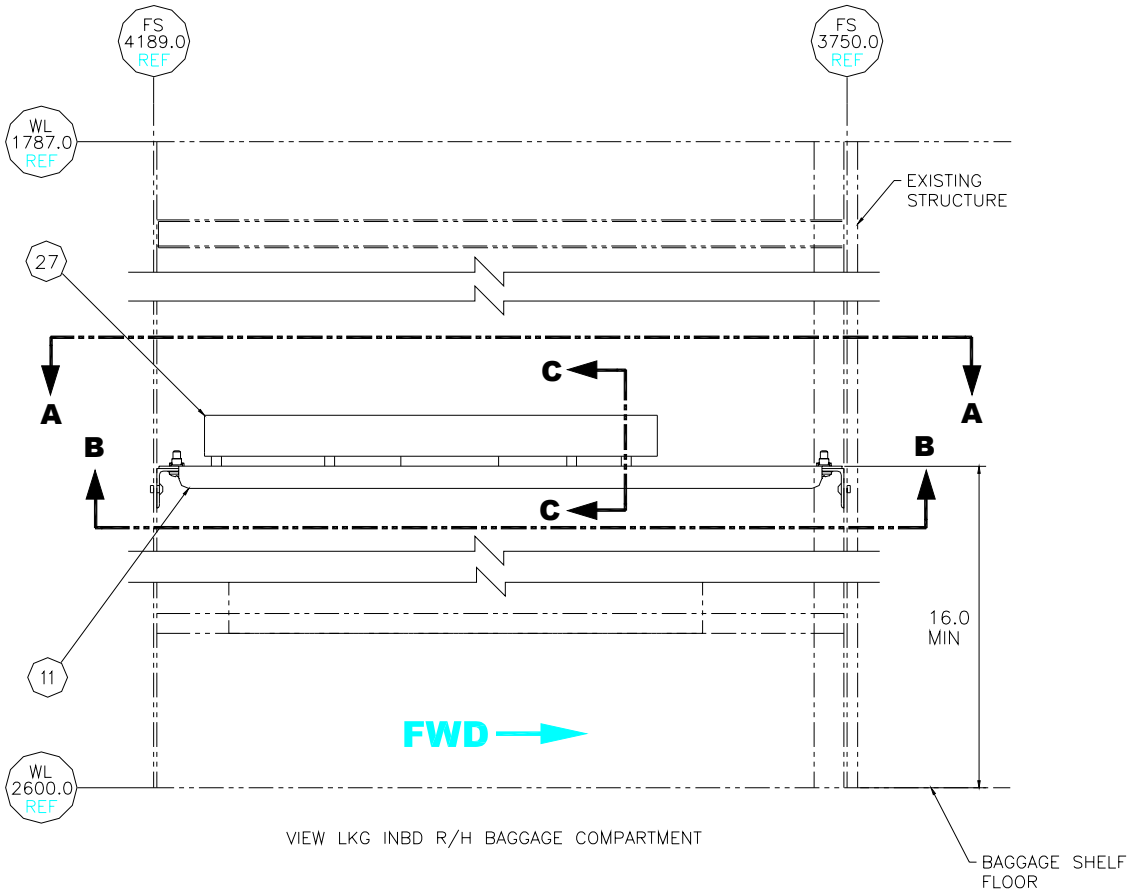

Figure F-7a Litef AHRS Mounting Side View

ITEM	DESCRIPTION	PART NUMBER
11	SHELF	
27	AHRS MOUNTING TRAY	124260

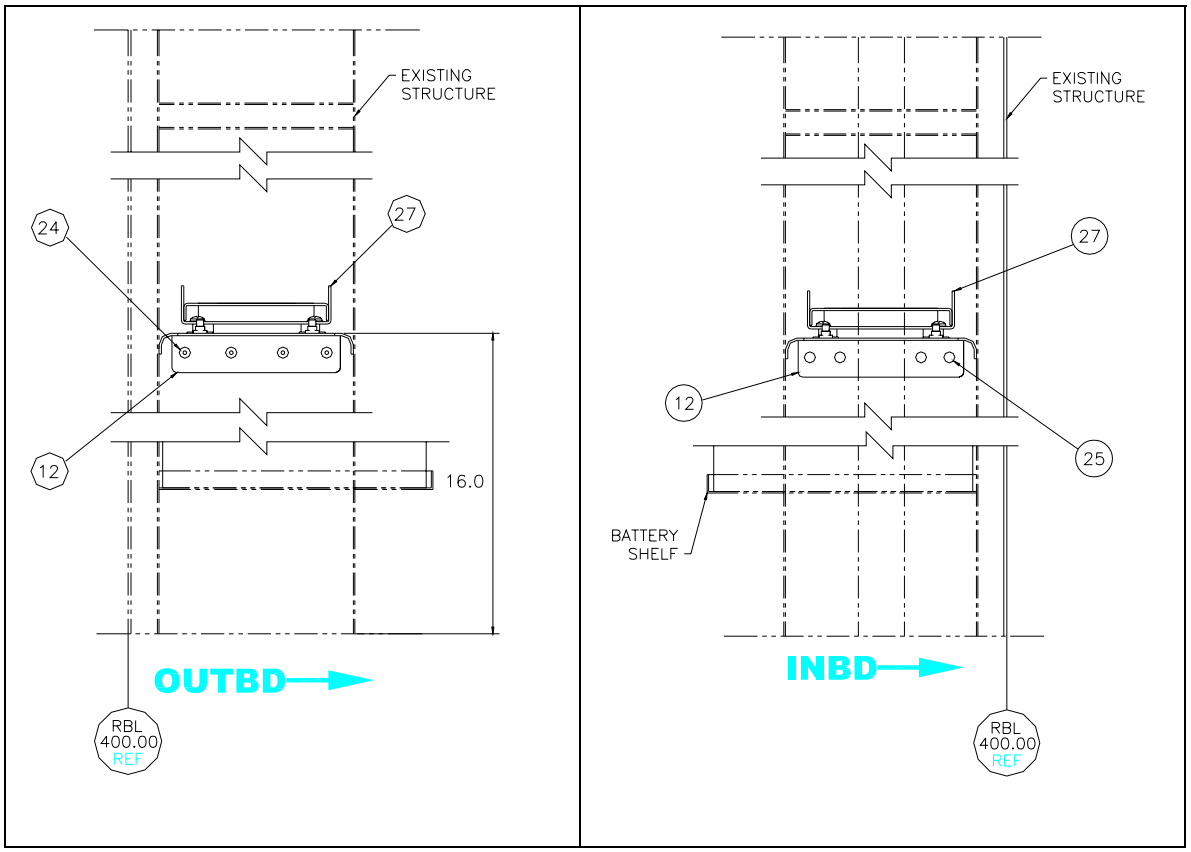

Figure F-7b Litef AHRS Mounting End View

ITEM	DESCRIPTION	PART NUMBER
12	ANGLE	
24	RIVET	CR3213-5-2
25	RIVET	MS20470AD5-3
27	AHRS MOUNTING TRAY	124260

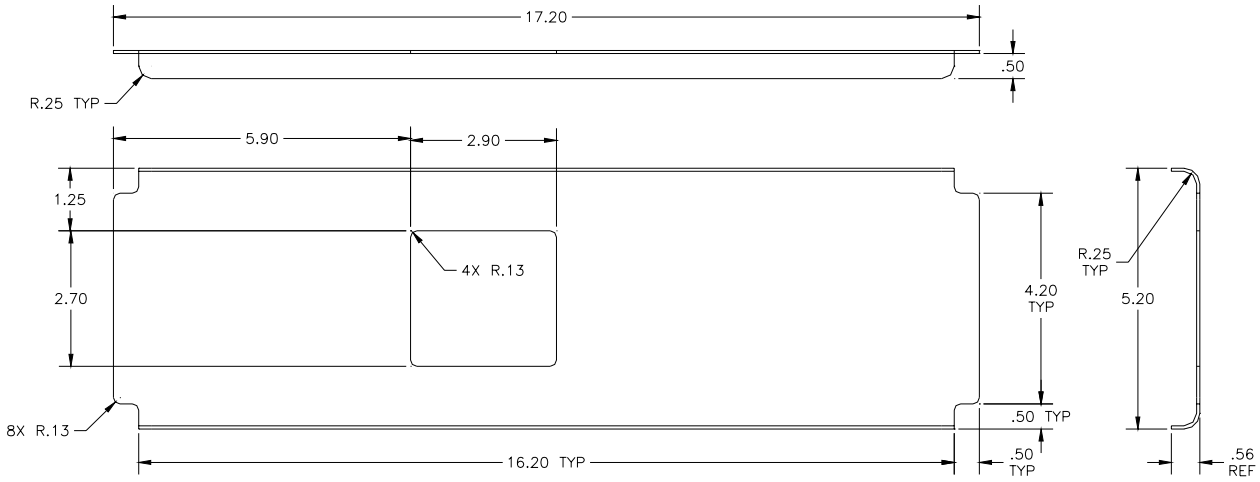

Figure F-7c Litef AHRS Mounting Shelf

ITEM	DESCRIPTION	PART NUMBER
11	SHELF 0.063”	AL.ALLY-2024 T3

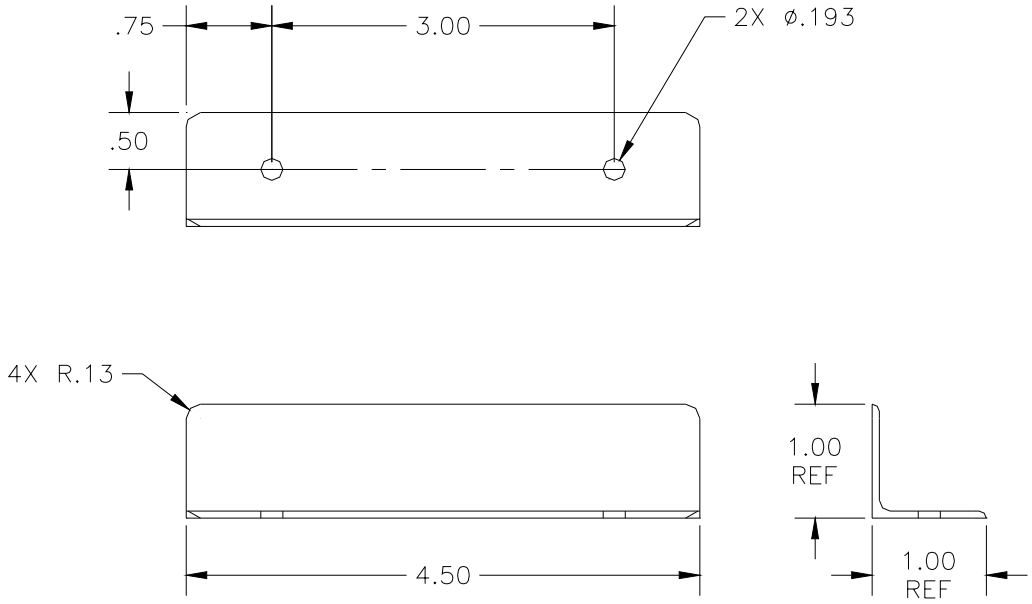

Figure F-7d Litef AHRS Mounting Angle

ITEM	DESCRIPTION	PART NUMBER
12	ANGLE AL.ALLY 2024-T3	AND10133-1001

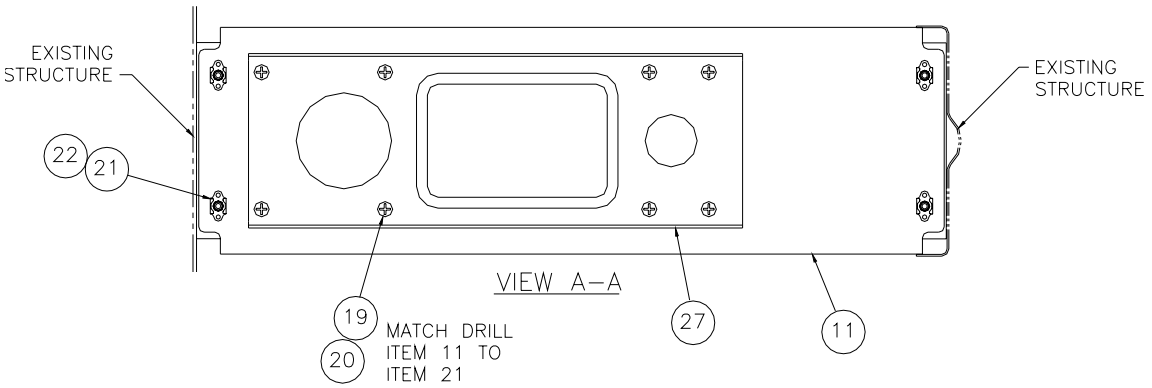

Figure F-7e Litef AHRS Mounting Top View

ITEM	DESCRIPTION	PART NUMBER
11	SHELF	
19	SCREW	MS27039-1-08
20	WASHER	NAS1149D0316K
21	NUTPLATE	MS21075L3
22	RIVET	MS20426AD3-3
27	AHRS MOUNTING RACK	124260

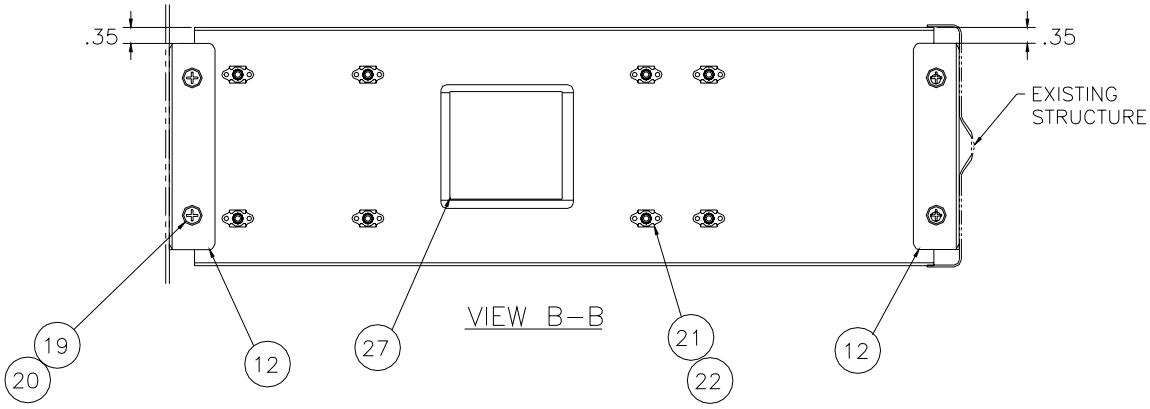

Figure F-7f Litef AHRS Mounting Bottom View

ITEM	DESCRIPTION	PART NUMBER
12	ANGLE	
19	SCREW	MS27039-1-08
20	WASHER	NAS1149D0316K
21	NUTPLATE	MS21075L3
22	RIVET	MS20426AD3-3
27	AHRS MOUNTING RACK	124260

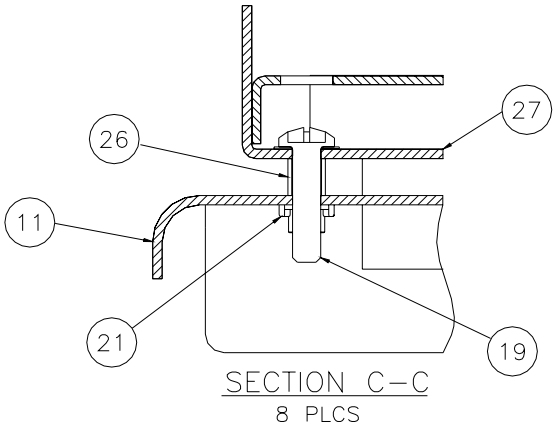

Figure F-7g Litef AHRS Mounting Detail

ITEM	DESCRIPTION	PART NUMBER
11	SHELF	
19	SCREW	MS27039-1-08
21	NUTPLATE	MS21075L3
26	SPACER	NAS43DD3-16N
27	AHRS MOUNTING RACK	124260

GPS Installation

The GPS antenna is mounted on the top of the cabin, between the upper canopy windows. Install the antenna as shown below.

For additional information on mounting the GPS system, refer to FreeFlight Installation Manual 84143-01 and Chapter 2 and Chapter 4 of this manual.

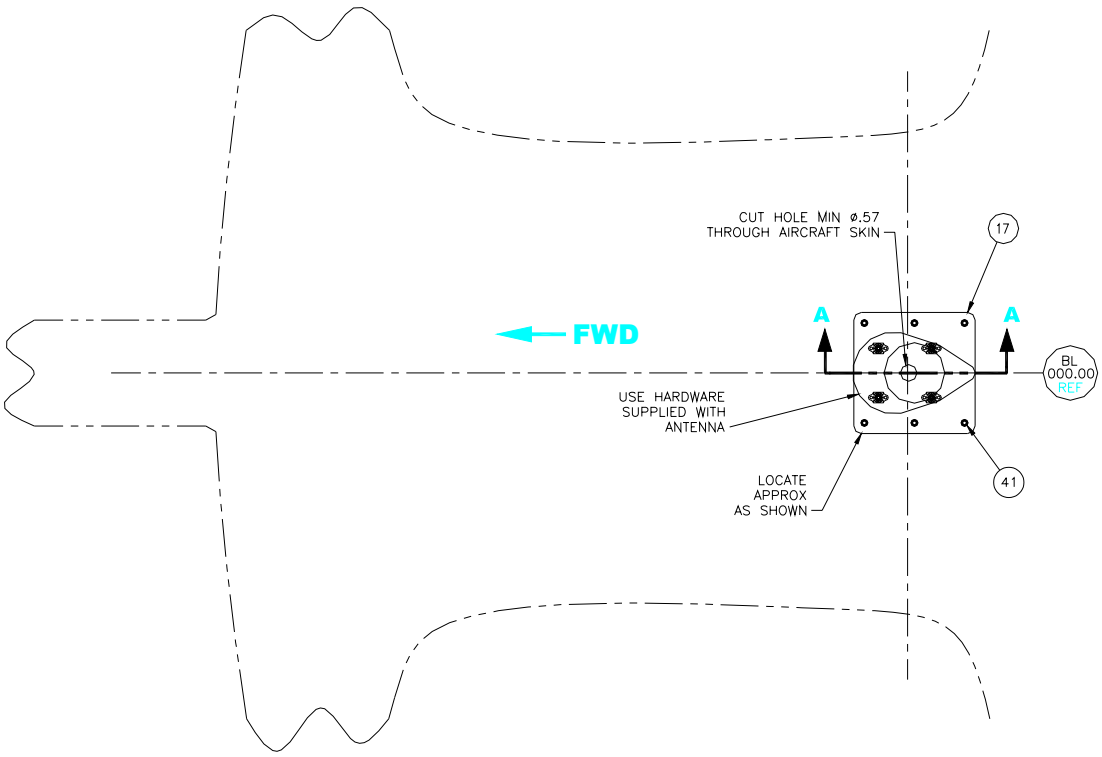

Figure F-8a Typical GPS Antenna Mounting

ITEM	DESCRIPTION	PART NUMBER
17	DOUBLER	
41	RIVET	CR3212-4-2

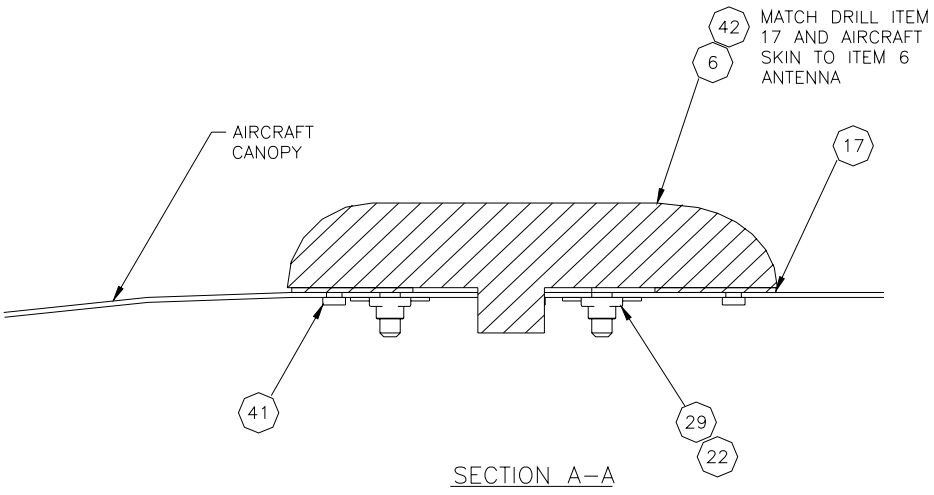

Figure F-8b GPS Antenna Mounting

ITEM	DESCRIPTION	PART NUMBER
6	ANTENNA	
17	DOUBLER	
22	RIVET	MS20426AD3-3
29	NUTPLATE	MS21075L08
41	RIVET	CR3212-4-2
42	SEALANT	C3204B2PT

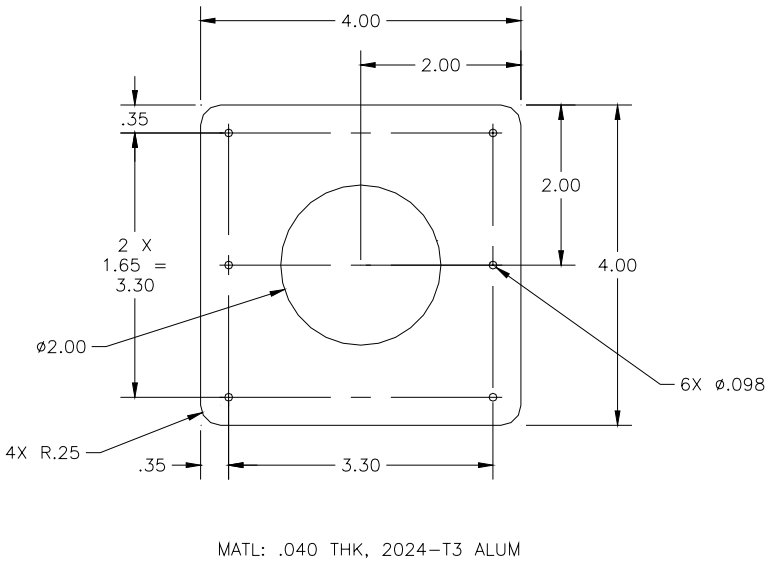

Figure F-8c GPS Antenna Doubler

ITEM	DESCRIPTION	PART NUMBER
17	DOUBLER 0.040”	AL.ALLY-2024 T3

The GPS receiver is mounted on the sub-floor, under the cabin aft of Station 2325.

Wire GPS and antenna per Chelton Flight Systems wiring diagram 702-045250, sheet 4 and 702-045251, and Chapter 4 of this manual. Antenna coax should not be more than 50 feet in length.

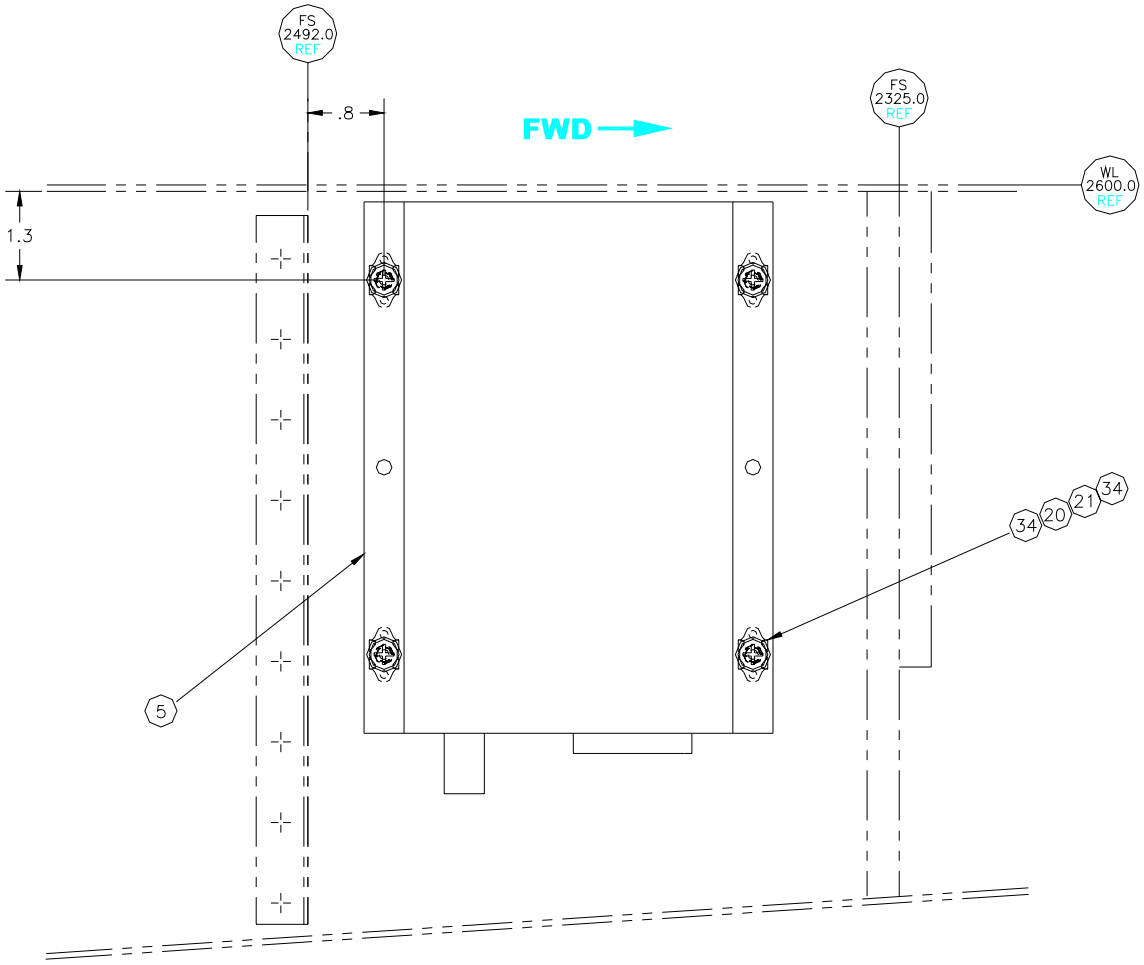

Figure F-8b GPS Receiver Mounting

ITEM	DESCRIPTION	PART NUMBER
5	GPS/WAAS RECEIVER	84100-01
20	WASHER	NAS1149D0316K
21	NUTPLATE	MS21075L3
34	SCREW	MS27039-1-08

AIU Installation

The Analog Interface Unit (AIU) is located below and forward of the Litef AHRS as shown in Figure F-4. The AIU is installed under the baggage floor with the connector facing aft.

Wire the AIU per Chelton Flight Systems wiring diagram 702-045250, sheet 6, 702-045251, AIU Installation Manual doc 570-7000, and Chapter 4 of this manual.

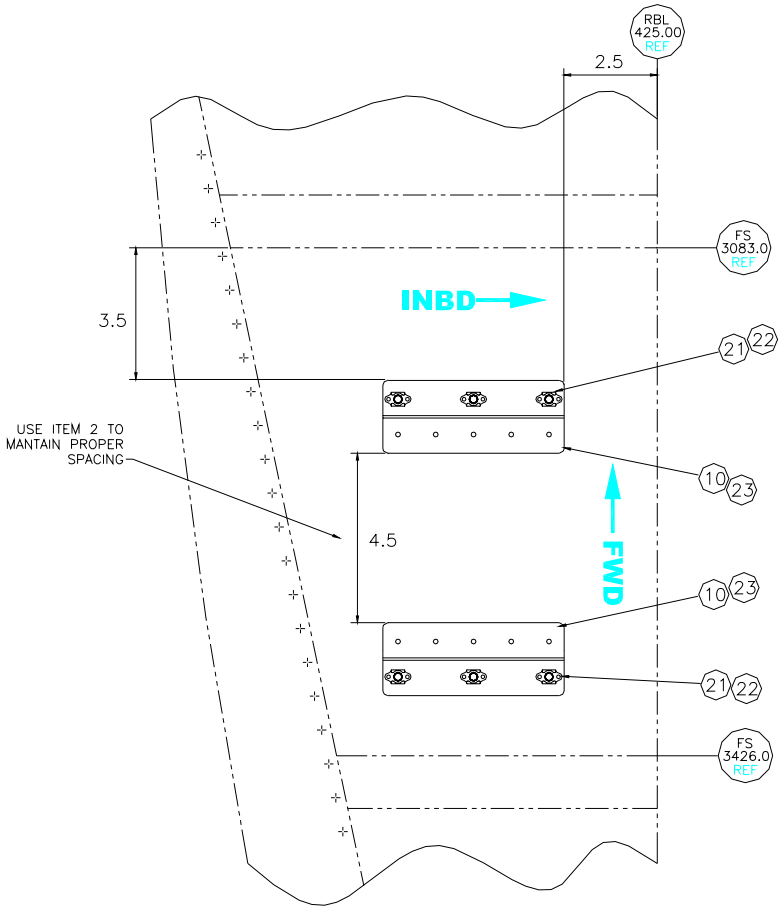

Figure F-9a AIU Mounting Location

ITEM	DESCRIPTION	PART NUMBER
10	ZEE ANGLE	
21	NUTPLATE	MS21075L3
22	RIVET	MS20426AD3-3
23	RIVET	MS20426AD4-5

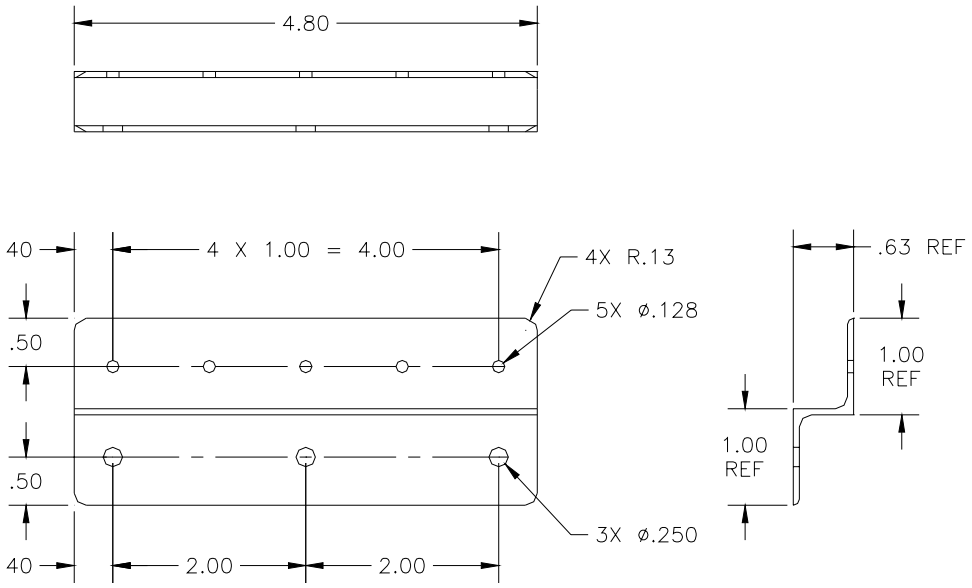

Figure F-9b AIU Mounting Bracket

ITEM	DESCRIPTION	PART NUMBER
10	ZEE ANGLE AL.ALLY 2024-T3	AND10138-0505

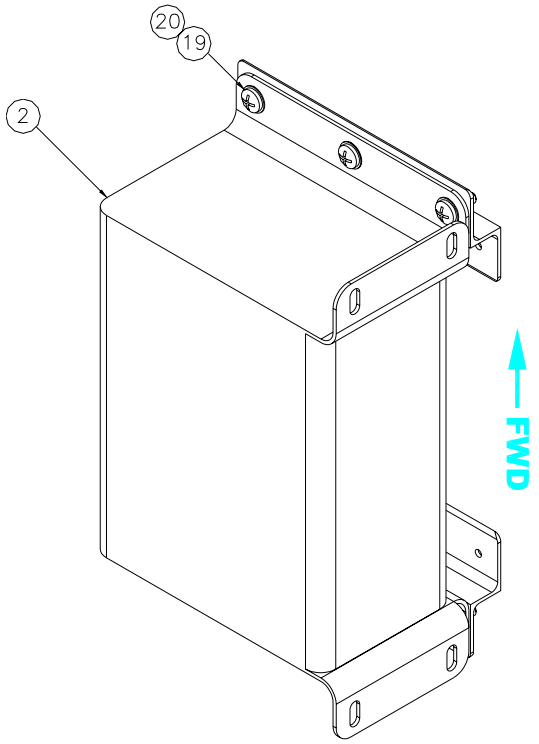

Figure F-9c AIU Installation

ITEM	DESCRIPTION	PART NUMBER
2	AIU	453-7000
19	SCREW	MS27039-1-08
20	WASHER	NAS1149D0316K

Post Installation Tests

Configure the EFIS per Chapter 5 of this manual.

Configure the AIU per Chapter 5 of the AIU Installation Manual.

Perform ground testing per Chapter 6 of this manual.

Perform flight testing per Chapter 7 of this manual.